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COMMUNICATION.] [FOR THE MAGAZINE.

### FESSENDEN'S PATENT LAMP APPARATUS.

Oil, or Alcohol, according to Count Rumford, is often the cheapest and most convenient fuel.

Mr. Editor,—Much trouble and expense may be saved, especially in small families, and during the warmer months, by a prudent use of liquid inflammables, such as oil and alcohol. Although, where a considerable quantity of heat is required, these substances are too expensive for general use, yet, when a quick, gentle, long continued, manageable and uniform heat, of not much intensity is wanted, these fluids may afford the cheapest, as well as most convenient combustibles. Their use, however, as sources of heat, has been hitherto chiefly confined to the laboratory of the chemist, and a small but convenient article, called the Nurse Lamp. Patents for applying fuel of a liquid kind, in larger quantities, and for culinary purposes, have been obtained in England and elsewhere, but the apparatus of the patentees has been, generally, if not always, either defective, complicated, or too expensive for common use.

The writer of this article has invented and obtained Letters Patent for "*A Lamp Apparatus for heating water, cooking, and other economical purposes*," which has been found very useful for small families, druggists, and such persons as have occasion to prepare tea, coffee, or chocolate, or cook eggs, oysters, &c. in their own apartments, without the trouble or inconvenience of a wood or coal fire. It is very convenient in publick houses, coffee houses, and other places, where it is wished to keep water, soup, or any hot liquid constantly on hand. Besides answering all the purposes of what is called the Nurse Lamp it may be made to boil from one pint to a gallon of water, by a method, which, in many cases, will be found the most economical and expeditious, which can be devised.


DESCRIPTION OF THE CUT.

A, Sheet iron case, in which the tea kettle, boiler, &c. may be placed, removable at pleasure. It has a hole in the bottom to admit the heat of the lamp to pervade the bottom and sides of the boiler, and a number of small holes in its sides, near the top, to permit the air to escape, and cause a draught through the hole at the bottom. B, Lamp, with five or six wicks, more or less, when in use, placed under said case. C, Pan or boiler, which, when in use, is placed in the said sheet iron case. D, Tea kettle, in its place for boiling. E, A small sheet iron cylinder, a little tapering, so as to form the frustrum of a hollow cone, and its sides pierced with small holes. This is occasionally placed within the case, so as to surround the hole in its bottom, in order to place on it a coffee pot, tea pot, flask, tin porringer, or other small vessel in which it may be wished to heat water &c.

DIRECTIONS FOR USING THE APPARATUS.

The lamp will answer for oil or alcohol. Oil is best when a long continued heat is wished for, and alcohol, when a quick but transient heat is the object. The wicks should be of such a size as completely to fill their tubes, but at the same time slip up and down with facility. When new they should be wet with the inflammable liquid before they are lighted. This is best done by drawing them so far through the tubes that you may dip their upper ends in the liquid in the lamp vessel, and then drawing them back, so that they may stand about

one sixth of an inch above the tops of the tubes. Light the wicks *before the lamp is put under the boiler, and, with the wire, which is furnished with the apparatus, elevate or depress them till they give a full blaze without any perceptible smoke.* After the lamp is placed under the boiler, if oil is used, should you perceive the appearance of smoke, or the blaze should touch or blacken the bottom of the boiler, put the wicks down a little, that they may give a full blaze without smoke. When you commence using this apparatus, it may be well to place it on a table, that you may conveniently inspect it, till it is in full operation.

When the water begins to boil you may keep it at a boiling temperature by two or three wicks only, the rest being extinguished by putting them down in the tubes. A cap or extinguisher should be placed over the tubes, when the lamp is not in use, especially when alcohol is burnt, to prevent evaporation, and to keep the wicks moistened with the inflammable fluid, that they may be the more easily lighted. The wicks will kindle with the more readiness, when oil is used, if their ends are touched with spirits of turpentine, before the match is applied. It is thought to be more economical, when oil is the fuel, to employ no more wicks than will be sufficient to raise the water to a boiling temperature in about an hour; say five or six wicks in the lamps which contain ten wicks. Five or six may be lighted at first, and if the water does not appear to be about boiling near the time it is wanted, the remainder may be kindled to hasten the process.

It has been found very convenient to occasionally make use of two lamps for the same apparatus; one for burning alcohol, when it is wished to boil water in a short time, and another for oil, when a long continued heat is wished for, or economy is more of an object than expedition. When alcohol is used it is well not to keep any more of the liquid in the lamp vessel than is wanted immediately, as there will be in such case, a loss by evaporation. What is not consumed should be turned back into a bottle, or some other proper receptacle, and the air excluded by a cork or otherwise.

### REMARKS BY THE PATENTEE.

Since the patent for this apparatus was obtained, (which is dated January 1, 1827,) it has been used and recommended by many respectable persons in Boston, Cambridge, Charlestown &c. By these it has been ascertained, that the lamp of the largest kind, when oil is used, will boil upwards of three quarts of water in less than fifty minutes, and that "one quart of oil will boil forty quarts of water, at different times, and supply the heat necessary for preparing tea or coffee with that quantity of water. Mr. William W. Clapp, proprietor of the Boston Evening Gazette, has stated that this apparatus "is attended with very little trouble, and requires no other fuel than a pint of oil per week, (amounting to ten cents only) to boil the kettle once a day, containing three quarts of water, in about forty minutes. It likewise is found particularly useful to druggists, and has been purchased and recommended by nearly all the druggists in Boston and Charlestown. They state, that this lamp apparatus furnishes the most convenient, cleanly, and economical method for preparing infusions, sirops or ointments. That in ten minutes it will boil one quart of water. The quantity of alcohol consumed is but one ounce; the expense one cent," &c. &c.

It was observed by Count Rumford, in an "*Essay on the Qualities of Coffee, and the Art of making it,*" that "It is a curious fact, but is nevertheless most certain, that, in some cases, spirits of wine is cheaper, when employed as fuel, even than wood."* This remark applies with still more force to oil than to alcohol. A pint of oil during its combustion in a lamp, gives out more than double the quantity of heat, which is yielded in burning a pint of alcohol in the same lamp. According to experiments of Count Rumford, a pound of rape oil during its combustion evolved heat enough to melt 124 lbs. 10 oz. of ice, and it seems, from experiments by Mr. Dalton, that a pound of alcohol in burning, would melt no more than sixty pounds of ice. Oil, however, burning more slowly, produces from a lamp a much less quantity of heat *in a given time* than alcohol will yield from the same lamp in the same time. Oil, compared to alcohol, as an article of fuel, is like green oak, compared to dry white pine; oil, burning more slowly than alcohol, yields less heat for the time being, but gives out more heat during the whole combustion of a given quantity.

The Patentee rests his claim for an exclusive right to his invention, not on producing a new effect, (for there is nothing new in boiling water &c. with a lamp,) but

* See Repertory of Arts, vol. xxii. second series, p. 298.

on producing common and useful results, with a simple, cheap and convenient *apparatus*, which, if not new in all its parts is at least new in its combinations. The novelty of the invention consists

1. In a simple and cheaply constructed lamp, so formed that either oil or alcohol may be burnt in it with equal advantage; and so modifying and arranging the wicks as to render it more easy to increase or to diminish the heat at option than in common lamps. For instance, one of my patent lamps, which has ten wicks, may be made to boil, by using alcohol, a gallon of water in less than twenty minutes, or, used with oil, may be so regulated as barely to keep a single pint at a simmering heat for any required length of time.

2. In providing a case of sheet iron, or other suitable substance, which surrounds the boiler, in such a manner that the heat of the lamp pervades, and is in a great measure confined to the bottom and sides of the boiler. By this arrangement, "little if any of the heat of the lamp can possibly escape, unless it be through the fluid in the boiler." This case, likewise, together with the sheet iron conical cylinder figured above, presents a *stand* or *position* on which may be placed a pan for frying, vessel for cooking by steam, glass flask, and other vessels used in cookery, or in the laboratory of the chemist.

3. In ascertaining by many experiments, and prescribing in the specification of the patent, the distance between the top of the tubes of the lamp, and the bottom of the boiler, when the apparatus is in operation, in order that there may be room for the smoke to be consumed without having the boiler placed at too great a distance from the lamp to receive its heat with the greatest advantage.

4. By placing the lighted lamp immediately under the cavity, between the bottom and sides of the boiler and the inside of the case, a current of heated air is formed, which strikes with some force against the boiler, and thus forms a sort of miniature culinary *air furnace, to the blast of which* the boiler is exposed, and the heat thus forced into its contents.

5. The cavity within the case produces an effect on the blaze of the lamp, similar to that which is caused by the chimney to an Argand lamp; becoming a *blower to the lamp*, and a stimulus, which causes the more complete combustion of the oil.

6. It is a fact well known to chemists that combustion, at least in common cases, is the consequence of the rapid combination of the oxygen of the atmosphere with the burning body, and that the greater part of the calorick yielded in the process of burning is derived from the air, which comes in contact with the burning materials. Ignorant of this fact, many inventors, who have heretofore attempted to heat water, &c. by a lamp, have partially or wholly enclosed the lamp in the same case or enclosure with the boiler. This has proved doubly disadvantageous; viz. 1. In endeavouring to *shut in the heat*, they have, *shut out the air*, thus depriving themselves of what may be styled the *fuel of the atmosphere;* and contriving a partial or total extinguisher to the blaze essential to their anticipated operations. 2. By fixing the lamp in the same case or enclosure with the boiler, they have heated the oil in the former in such a manner that it would distil away rapidly, and if alcohol were used it was apt to take fire in the reservoir or lamp vessel. But in the above described apparatus the vessel which contains the oil or alcohol to supply the lamp is placed in the open air, for the purpose of keeping its contents cool, and the heat evolved passes immediately in a current of flame and hot air into the cavity above mentioned surrounding the sides and the bottom of the boiler.

The lamp apparatus is not recommended except when only a small quantity of heat is required. But, in that case, it presents the following, among other advantages. It may be used in an apartment without a fire place, or set on a tea table. When well trimmed, and properly lighted, it will burn at least twelve hours without attendance. It may be lighted in a minute, and its effect, with a little use, calculated exactly; so that, if lighted in season, no time need be lost in *waiting for the tea kettle to boil.* Oil or alcohol furnish a very portable fuel, convenient for carrying to sea, &c.; and if, as Count Rumford has observed, they are, in some cases, a cheaper fuel even than wood, it must be expedient to use them in *such cases.*

A vessel for cooking by steam, a boiler to hold about a gallon, or a frying pan may be placed in a case, (as the tea kettle is represented in the cut,) and thus the common operations of cooking, excepting broiling and roasting, be performed. And where small quantities of provisions only are required to be cooked by boiling, steaming, or frying, (which is nothing more than boiling

in fat) this apparatus is believed to present the cheapest and most convenient method of effecting the object.

With respect, and the best wishes for your publication, and the objects it embraces,

your obedient servant,

THOMAS G. FESSENDEN.

N. B. Apparatus of the above description may be obtained at the office of the New England Farmer, No. 52, North Market Street, Boston.

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## *Mode of Computing the Power of a High Pressure Engine. By Mr. Charles Potts. Philadelphia.*

(Concluded from page 125.)

The method of finding the maximum of variable quantities being particularly interesting and useful, in many questions relating to mechanicks, the following will be found useful to those who may be unacquainted with the fluxional or differential calculus.

Let $a$, denote any constant quantity, and $x$ being supposed to vary; then when $x \times \overline{a-x}$ becomes a maximum, we shall have

$$x = \overline{a-x} \text{ or } x = \frac{a}{2}$$

This proposition may be readily demonstrated by supposing $a$ to represent the diameter of a semicircle, and $x$ and $a-x$ the segments of this diameter formed by a line drawn from the circumference perpendicular on the diameter, for it is known that the product of the segments is always equal to the square of the perpendicular, and this is the greatest when it divides the diameter into two equal parts. From this it also follows, that $x \times \overline{a-x} \times \overline{a-x}$ or $x \times \overline{a-x}^2$ will be a maximum when

$$x = \frac{1}{2}(a-x) \text{ and consequently } x = \frac{a}{3}$$

When $x \times \overline{a-x} \times \overline{a-x} \times \overline{a-x}$ or $x \times \overline{a-x}^3$ becomes a maximum, then $x = \frac{1}{3}(a-x)$ or $x = \frac{a}{4}$. And in general when $x \times \overline{a-x^n}$ becomes a maximum, then

$$x = \frac{1}{n}(a-x) \text{ or } x = \frac{a}{n+1}$$

If, for example, W denotes the absolute effort of any moving force, when it has no velocity; and suppose it not capable of any effort when the velocity is $a$; let $f$ be the effort answering to the velocity $u$; then the action being supposed constant, it will vary as the square of the efficient velocity, hence $W : f :: (a-o)^2 : (a-u)^2$ and, consequently,

$$f = \frac{W}{a^2} \times \overline{a-u}^2.$$

The momentum of the force will be

$$fu = \frac{W}{a^2} \times (u \times \overline{a-u}^2)$$

which is obviously a maximum when $u \times \overline{a-u}^2$ is the greatest, the quantities, W and $a$, being considered invariable. From what has already been shown, $u \times \overline{a-u}^2$ will be a maximum, when

$$u = \frac{1}{2}(a-u) \text{ or } u = \frac{a}{3}$$

This is the theorem that we before alluded to, viz: that when the velocity with which any engine works is one-third of the greatest velocity with which it is capable of working, then will the work done be the greatest possible.

In this conclusion, however, it must be understood that the quantity of weight only is considered, no regard being paid to the variations of friction arising from the motions of the weight.

Let D, as before, express the force or pressure of steam, and put $1 : m$ as any given weight on the piston, is to the resistance which would arise from the friction of this weight, when the engine worked with a given velocity, $a$.

From the construction of the steam engine, it is obvious, that when the engine works without any load, the resistance which arises from weight must be comparatively small; let it be assumed, therefore, equal to unity per square inch on the piston when the velocity is $a$, and pressure D, then

$$a = \frac{O}{A} \times v \sqrt{\frac{H}{h}\left(\frac{D-\overline{m+1}}{D}\right)}$$

and $a$, will express the greatest velocity with which the engine is capable of working.

Let $u$, denote the velocity of the piston, when loaded with a weight, L, the motion of the engine being uniform; then supposing the friction to be always in the compound ratio of the weight and velocity, the friction arising from the load when the velocity is $u$, will be

$$\frac{mLu}{a}$$

and that from the parts of the engine will be

$$\frac{mu}{a}$$

Hence, putting W, equal to the weight that would completely stop the motion of the engine, we shall have

$$\frac{W \times \overline{a-u}^2}{a^2}$$

equal to the power or action of the engine.

Now when the motion of the engine becomes uniform, the action and resistance become equal, consequently,

$$\frac{W \times \overline{a-u}^2}{a^2} = L + 1 + \frac{mLu}{a} + \frac{mu}{a}$$

from whence we obtain

$$L = \frac{W}{a} \times \frac{\overline{a-u}^2}{a+mu} - 1$$

and when the momentum of the load becomes a maximum, the velocity, $u$, will be found by resolving the following equation: $2mu^3 + (3a - 2am)u^2 - 4a^2u + a^3 = 1$.

If now we suppose the friction, $m$, to be constant, or not *increased by the augmentation of velocity*, and $rW$, to represent the resistance of the engine when operating without a load, then

$$\frac{W \times \overline{a-u}^2}{a^2} = L + mL + rW,$$

and consequently,

$$L = \frac{W}{a^2 + ma^2} \times (\overline{a-u}^2 - ra^2.)$$

When the momentum of the load, $Lu$, becomes a maximum, we shall find the velocity

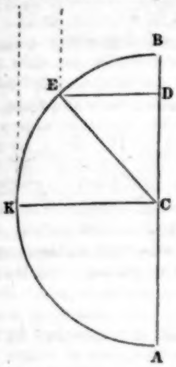
$$u = \frac{a}{3} \times (2 - \sqrt{3r+1}.)$$

It is obvious that $rW$, may be taken to express both the loss of power from the *weight and friction of the engine*, and also that which arises from the nature of *crank motion*. Before we give an

example in illustration of the preceding rules, it may be well to say a word or two with regard to the crank.

In a paper formerly presented, in answer to an abstract question, "Whether the crank involved a loss of power," I endeavoured to show the affirmative by simply calculating the effort of the crank at several points in its revolution, and comparing it with the power or energy applied at the same places.

As it is important in computing the power of a reciprocating steam engine, that due allowance should be made for the loss sustained from the application of the crank in its construction, we shall again revert to the subject.




Let AB, in the above figure, represent the diameter of the circle described by the crank; then will AB, also, be the length of a single stroke of the engine, and if F be supposed equal to the effective force on the area of the piston, then F $\times$ AB, will be the momentum, or weight, the engine could raise, supposing no crank to intervene.

Suppose, now, in the application of the crank, the mechanical contrivance is such, that the *connecting rod* acts on the crank CE, always parallel to AB, (*to the piston rod*,) then when the crank is at *right angles* to AB, or the connecting rod, the *whole energy* of the power, F, will be effectual in turning the crank. The effort of the power to turn the crank at any other point, as at E, will be as the effective lever DE, hence as

$$CK : DE :: F : \frac{F \times DE}{CK} =$$

to the effort of the crank at the point E. And it is easy to see, that, as the line DE, in a single stroke of the engine, would describe the semicircular area AKEB, the *sum of all the efforts of the crank* will be

$$\frac{F}{CK} \times \textit{area of semicircle.}$$

Hence, putting AB = the diameter of the circle = 1, then CK = the length of the crank = $\frac{1}{2}$, and the area of the semicircle

$$AK\,EB = \frac{.7854}{2}$$

Consequently, F $\times$ AB will be equal to F, and the sum of all the efforts of the crank will become

$$2\,F \times \frac{.7854}{2}$$

equal to F $\times$ .7854. From whence it follows that F : F $\times$ .7854 : : 1 : .7854. And we shall have the loss of power from the crank equal to 1 — .7854 equal to .2146, or 1-5th, nearly.

In an engine working without a beam, where the connecting rod passes immediately from the cross head to the crank of the *fly wheel*, the proportion between the rod and crank being as 6 to 1, the loss will be found equal to 3-10ths, nearly. And in the *lever beam construction*, particularly when the *stroke is long and beam short*, considering both crank and parallel motion, the loss in transmitting the power from the piston to the fly wheel, will be still greater.

In the above demonstration we have supposed the force, F, acting on the piston, to remain constant during the stroke. It is known, however, that as the velocity of the piston is continually accelerated from nothing at the top and bottom of the cylinder, to its greatest velocity at or near the middle, resembling in this respect the oscillations of a pendulum; and because the force varies as the square of the relative velocity of the steam and engine; if we suppose the force on the piston to be F, when the engine has no velocity, as at the top or bottom of the cylinder, and that the force on the piston is $f$, when the relative velocity is $(1 - \frac{1}{3})$ or $\frac{2}{3}$, we shall have $f = $ 4-9 F.

This circumstance has induced some persons to infer, that, as the force on the piston diminishes as it approaches the middle of the cylinder, whilst the effort of the crank at the same time increases, a just equilibrium is maintained, and hence no power lost.

In the demonstration that has been given, let F, now, be taken equal to the force on the piston, when at the middle of the cylinder, (as at C,) and that when the piston is at D, the force has increased to $d$F. When the force is constant, the effort of the crank at E, will be

$$F \times \frac{DE}{CK}$$

and it is evident, if the force on the piston has increased to $d$F, that the effort of the crank will become

$$dF \times \frac{DE}{CK}$$

hence the ratio between the power and the effect will be the same, whether the power is constant or variable.

The comparative advantage between engines with long and short cylinders may be readily inferred from the above illustration of crank motion.

We shall now exemplify the preceding observations, by supposing the following case:

It is intended to work a high pressure steam engine, with a force per square inch on the safety valve equal to 150 pounds, the area of the piston being 50 square inches, and the loss from crank motion equal 3-10ths of the power. It is found by trial that a pressure equal to *three pounds* per square inch on the piston, is amply sufficient to overcome the weight and friction of the engine when unloaded, or that this pressure will start the engine when the piston hangs midway between the centres. Required the velocity, load, and power of the engine when operating to the greatest advantage.

Friction being supposed constant, we shall have $a$, the utmost velocity with which the engine is capable of working,

$$a = \frac{O}{A} \times v \sqrt{\frac{n \times (D - rW)}{D}} \text{ where } \frac{O}{A} = \frac{1}{50}$$

as formerly, $v = 644$ feet, and it is obvious that

D, the effective force of the steam on the piston, is equal W, the weight that would stop the engine.

The resistance of the engine being 3 pounds per square inch, or 1-50th of the power, we have

$$r = \frac{3}{10} + \frac{1}{50} = \frac{32}{100}$$

whence $D = W = 150$ lbs. $D - rW = 102$ lbs. and the ratio between the common atmospherick pressure and the active pressure of the steam, equal

$$n = \frac{102}{15}$$

These values substituted in the above formula, will give $a = 30$ feet per second, the velocity with which the engine would run without a load.

When the engine is loaded the performance will be a maximum when its velocity

$$u = \frac{a}{3} \times (2 - \sqrt{3r + 1}) = \frac{30}{3} \times (2 - \sqrt{3 \times \frac{32}{100} + 1}) = 6 \text{ feet per second, or 360 ft. per minute.}$$

From experiments by Coulomb and others, the friction of iron gudgeons working in brasses, was about 1-6th of the weight, and it was also determined that this friction was very little, if any, increased by an augmentation of the velocity.

Hence, from the foregoing expression for the load, we have

$$L = \frac{W}{a^2 + ma^2} \times \overline{(a - u^2 - ra^2)}$$

whence, by substituting 150 for W, 30 for $a$, 6 for $u$, 32-100 for $r$, and 1-6 for $m$, we shall obtain

$$L = \frac{144}{525} W = 41$$

pounds per square inch on the area of the piston; the load the engine may carry, independent of the weight and friction of the machine.

The momentum of the load $Lu$, per minute, when the engine performs to the greatest advantage, will be $41 \times 360 = 14760$ lbs. per sqaure inch, and multiplying by the area of the piston, 50, we have 738000 lbs. the whole momentum of the engine per minute.

Assuming the standard of horse power equal to 32,000 lbs. raised 1 foot high per minute, the power of the engine will be equal to 23 horses.

## ENGLISH PATENTS.

*To John Applegarth, Printer, for improvements in Block Printing. Dated January* 26, 1828.

The improvements for which this patent has been granted, are produced by an apparatus, which will facilitate the accurate arrangement of the square blocks employed in calico printing, when used successively for the continuation of a given pattern. This apparatus is composed of two principal divisions, the first being of the nature of a table or stand, on which the calico, or other stuff required to be printed, is to be laid to receive the impression of the blocks; and the second consisting of a frame, that fulfils the chief purpose of the object of the patent.

The table, or stand, is made of horizontal stone slabs, a little exceeding the breadth of the stuff, and of the same length, (as represented in the drawing belonging to the specification,) being intended for printing handkerchiefs, or shawls. These slabs are placed successively in one line, within about an inch of each other, on parallel brick walls, of between two and three feet in height, and over them a thick piece of blanket, or other proper woollen stuff is laid, which is either nailed to pieces of wood fixed beneath the intervals between the stone slabs, or is kept down by metal rods placed across in the same intervals, and passed through staples secured to the walls at each of their ends. A frame is then prepared to lay over this table, containing as many square compartments as there are slabs, which is fastened at one side of the table to hinges, that project from each of the supporting walls for that purpose, which allow the frame either to lie horizontally in close contact with the slabs, or to be raised up vertically, when the calico or other stuff is being laid on the slabs, or removed from them. At one extremity of this table of slabs a row of tenter hooks is placed across, to which one end of the piece to be printed is fixed, and it is then laid evenly over the slabs, and fastened down in the intervals between them by the rods passed through the staples before mentioned, after its farther end is drawn tight by means of a cross bar of wood, to which it is attached by a similar row of tenter hooks, that is either fastened to the other end of the table by cords, or is drawn towards that end by weights attached to the extremities of the same cords.

Supposing the calico, or other stuff, to be properly arranged, and fastened down evenly over the table of slabs, and the frame to be let down horizontally in contact with its surface, a block is then to be taken, having a fourth of the area of one of the square compartments of the frame, on which the pattern preferred has been cut, so that the joinings of the figure may fit accurately, on shifting its position; and the colour having been applied to its face, either by dipping it on the colour-sieve, or by colour-rollers, it is then to be pressed down by a blow or other means, in one corner of the first square compartment of the frame, then in the next corner, and so on successively through the other remaining corners; care being taken to keep the proper angle of the block next the corners of the compartment; one handkerchief or shawl being thus stamped, the same process is to be repeated in all the other compartments of the frame, until the whole piece is completed.

When a medallion, or other central figure, is to be impressed on the middle of the handkerchief, or shawl, then a movable frame is to be formed of four pieces of wood, of the length of one of the compartments, crossed so over each other (by dividing the joinings) as, when laid in the compartment, to divide its area into nine equal squares; in the central square of these, a block, having the whole of the intended medallion, or other

figure, cut on its face, is then to be stamped in the manner before described; or a block having a quarter of the same figure cut on it, (and of course of only a fourth of the area of the central square,) may be used; and the impression be made of the whole figure by four successive operations, in the same way as with the larger blocks in the process first recited.

When only a border is to be stamped on a shawl or handkerchief, the patentee directs that a block of another shape be used; which is to be of the breadth of the intended border, and of such a length as to extend from one angle of the square compartment of the guiding frame to within a distance equal to its breadth of the adjoining angle; and the pattern proper for the angle of the border, having been cut at the end of the block, placed in the first instance close to the angle of the square compartment; at the next transfer, that end of the block is to be laid in the space left at the extremity of the first impression, where it will form the second angle of the border, and the block being applied successively at the other sides of the compartment in the same manner, will at the fourth impression complete the border.

Obs.—It appears to us, that the improvements of the patentee would very much facilitate and accelerate the operation of block printing, besides increasing the accuracy with which the joinings of the impressions would unite so as to form a perfect uniform design, or pattern; but on the other hand we understand that the process of printing piece goods by rollers, both engraved, and cut so as to act like blocks, has been brought to such perfection, and so much excels in rapidity of execution and precision, any thing that can be done by the manual application of blocks, as to leave the patentee but small chance of superiority in the competition with a rival of so much power and excellence.—(Rep. Pat. Inven.)

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*To Jonathan Brownill, Cutler, for an improved method of Transferring Vessels from a Higher to a Lower Level, or from a Lower to a Higher Level, on Canals; and also for the more conveniently raising or lowering of weights, carriages, or goods on rail-roads, and for other purposes. Dated* 1st *May,* 1828.

In the method of passing boats from one level of a canal to another, proposed by the patentee, the upper level is made to approach close to the vertical line over the end of the lower level, by banks properly constructed and faced with masonry, which advance somewhat more than the length of a canal boat, at each side of the lower level, at the same height as on the upper level, where the masonry forms walls at both sides, similar to those of a canal lock. A water tight caisson is then prepared sufficiently longer than the boat to receive it within its bounds, and a vertical paddle or sluice, running in grooves, is formed at its two ends, which two paddles, when let down, enclose the boat and the body of water in which it floats, so as to retain the latter without leakage; strong frame work is then erected on the two walls at each side of the end of the lower level, on which the axles of large vertical grooved wheels are supported parallel to the canal, so that the edges of the wheels may project at both sides some distance beyond the banks; which in that part are either made entirely of masonry, or at least very nearly so, to enable them to have sufficient strength to support the loads they have to bear, without being broader than is absolutely necessary for this purpose; two at least of the grooved wheels must be placed as mentioned on each of these walls, and over them ropes are to be passed from the caisson that holds the boat, to two other caissons of about the same length, but of only about half its breadth, which are solely to hold water sufficient to balance that in the former; these two small caissons are to be sustained by the ropes, at the top near the wheels, when the large caisson is in the lower canal; and on the contrary, when the large caisson is at the top opposite to the upper level, they will then lie at their lowest depth, descending at the opposite sides of the vertical banks as the former becomes elevated.

Paddles or sluices are fixed across in grooves, similar to those in the large caisson, at the termination of the upper level of the canal, and at the end of the lower level, close to the entrance of the space between the banks, and when the caisson is brought opposite to either of them, its end is pressed so close to it, (by means that will be described,) that the space between them will retain water; and a small paddle being first raised in the large paddle of the canal to let the water into this intervening space, the two large paddles of the great caisson and of the canal level next adjoining are then elevated, and the boat is either passed from the caisson into the level, or from the latter into the former, as the occasion may require.

To prevent the counterpoising smaller caissons from descending irregularly on the axles of the large grooved wheels, a very large toothed wheel is directed to be fixed at each side, of sufficient size to enable the two to meet over the middle of the intervening canal, and interlock with each other, so as to make the axles at the different sides turn round simultaneously in opposite directions. The patentee adds afterwards, that the same effect may be produced by other arrangements of intermediate wheels, if that mentioned should appear objectionable.

In the disposition of the apparatus that has been described, provision is only made for the equilibrium of the counterbalancing smaller caissons with the large one that is

to receive the boat; but to cause either of the weights, thus equipoised, to descend, for the above purposes, something more is necessary; this requisite, the patentee asserts, will be obtained by constructing the large caisson with a "false bottom," so as to divide it horizontally into two compartments, the upper one of which will act as has been stated, while the lower one is used as an additional balancing vessel, by pouring water into which, the large boat caisson over it may be made to preponderate when it is desired that the boat should pass from the upper to the lower level; and on the contrary, by letting water flow from it, the boat caisson will be made to rise, and convey the boat from the lower to the upper level, when this is necessary, by the preponderance of the smaller counterbalancing caissons, which will then occur.

We now come to the contrivance for pressing the end of the boat caisson against the frame of the sliding sluices, or paddles, at the ends of the different levels of the canal, before alluded to, which paddles perform the offices of lock gates; for this purpose a balance lever with unequal arms is placed at each end of the boat caisson, the shorter arm of which is furnished with a friction roller, which the longer arm by its greater weight causes to rise to a level with the centre of motion, when not counteracted; this latter arm points inwards towards the middle of the caisson, where its end is supported, when at rest, by the short horizontal arm of a bent lever, the longer arm of which rises vertically along the side of the caisson, so as to come conveniently within reach of the person who conducts the operation of the apparatus. The shorter arm of the first balance lever will, of course, from what has been stated, project outwards from the end of the boat, where its roller will come in contact with the slope of a double vertical inclined plane, made at the end of the enclosed space that connects the two levels, opposite to the sluice, against which the caisson is required to be pressed; so that when for example, the caisson is rising towards the upper level, the roller of the balance lever at the end of it, opposite to the upper level, will be pressed downwards, as it comes in contact with the lower slope of the double inclined plane, until it has passed the angle where the two slopes meet, when it will again descend to its former level; at which time, as before noticed, the long arm of the balance lever is supported by the horizontal arm of the bent lever; at this crisis some water is to be admitted into the lower compartment of the large boat caisson, to cause it to descend again a small space; which will make the roller pass down the upper slope of the inclined plane, and press the caisson in the opposite direction against the paddle frame of the upper level with the whole force of the weight of this caisson, (the long arm of the balance lever being prevented, by the means mentioned, from descending so as to yield to the action of the pressure on the short arm.) The method by which the balance lever and its roller, that is placed at the other end of the boat caisson, operate in pressing this caisson against the paddle frame of the lower level of the canal, is the same as that described, with the exception of the long slope of the inclined plane, that acts on the roller, being uppermost, and of course on the same level with the lower paddle frame and opposite to it, and that; when the pressure is required, water must be let to flow from the lower compartment of the boat caisson, to make it ascend a short distance, in order to produce the impulse necessary: in both cases padding, or stuffing, is advised to be used between the lines of contact of the boat caisson and the paddle frames, but no directions are given as to the formation, or peculiar arrangement of this padding. It will be observed that, when the caisson is pressed against the paddle frame of either levels, it is in a manner locked in that position by its own weight; so that some force will be required to remove this tendency, when the caisson is required to pass in the direction contrary to its former movement; but this force is readily supplied by the conductor by means of the long vertical arm of the bent lever; by hauling which he causes its short arm to ascend, that then elevates the long arm of the balance lever, and thereby forces the roller on its short arm past the angle of the double inclined plane. The patentee is aware, that the momentum of the descending caissons, when the apparatus is in action, should be counteracted at the end of each course, but he makes no other provision against this, than having a basin, or tank of water, placed under each of the smaller counterbalancing caissons, into which their momentum will cause them to plunge some distance at the termination of their descent, from which depressure the counterbalancing weight will again speedily elevate them; and when the boat caisson decends, the water in the lower level of the canal, into which it is to enter, will have a similar effect in counteracting its momentum. There is a reservoir placed at each side of the canal to supply water by pipes furnished with cocks, to the under compartment of the boat caisson, when necessary, which, however, appe s to us to be superfluous.

The second object of this patent,—of passing carriages and goods from one level of a rail-road to another—is effected by a water-counterpoise, in a manner similar to the preceding; a platform being prepared on which the carriage is drawn, which is then elevated to a higher level, when this is required, by two cisterns suspended by ropes over grooved wheels, supported at each side as before; into these cisterns water is let to

run from higher reservoirs, until the weight of the whole is sufficient to counterbalance that of the platform, and of the carriage with its load placed on its surface; when, on the contrary, the carriage is to be brought down from the higher to the lower level, after it is drawn on the platform, previously raised up for that purpose, water is let out of the counterbalancing cisterns until the platform and its load preponderate. To this latter apparatus a contrivance is added for economizing the water of the reservoir, which consists in placing three reservoirs, at different elevations, near the upper level of the rail-road, all of which communicate by pipes furnished with cocks, with a horizontal tube, that runs across from one system of reservoirs to the other. When the platform, with the carriage, is to be raised, water is first ejected from the two upper reservoirs into the two counterbalancing cisterns; the cocks of the former are then to be opened, until the level of the water within them becomes equal, and are to be then again closed; after this, water is admitted into the descending cisterns from the second two reservoirs; and again from the lowest pair in their turn, when the cisterns come down to their level. And when the platform is to descend, the water is to be let to run out of the counterbalancing cistern, first into the lower pair of reservoirs, next into the middle pair, and lastly, into the upper pair, as the cisterns ascend successively to their levels; the same management of the cocks belonging to their pipes of communication being observed on this occasion, as in the former instance.

The patentee finally observes, that an apparatus on the same principle as the last, may be used instead of a crane, for raising goods into warehouses, or taking them out of ships or carts, as well as for many other similar purposes.

Obs.—An apparatus for passing boats from one level of a canal to another, formed on the same principles as that of Mr. Brownill's was erected in 1809, by Mr. Woodhouse, on the Worcester and Birmingham canal at Tardebig, near Broomsgrove, and was worked experimentally for some hours every day for nearly a month in 1811. It was reported to perform very well, passing, on an average, nearly 60 boats in six hours, one-half loaded with from 15 to 20 tons, and the other half empty: and it was thought, that had the tunnel of Tardebig been completed in time, this ingenious engine would have been employed permanently; but as the canal company were obliged to use a steam engine to fill their summit level until the tunnel was completed, which superseded the use of the machine for that time, and for other reasons that were never explained satisfactorily by them, the machine was never used by the company in the transfer of goods.

The particulars in which the present patent apparatus differs from that of Mr. Woodhouse, consist in the employment of caissons of water in place of a mass of bricks, as a counterpoise to the boat and its load, and in using two sets of grooved wheels, one at each side of the canal, instead of the single set employed at one side at Tardebig: but the large caisson that held the boat, and the mode of passing the latter into it, and out of it, from and to the different levels, was the same as that which the present patentee proposes to use, as well as the counterbalancing principle on which the engine was worked.

Mr. Woodhouse used a contrivance for compensating the increased weight, caused, at the different sides of the apparatus, in the ascent and descent of the boat, by the connecting chains increasing in length at the descending side; but the present patentee has nothing of this nature in his engine; nor does he employ any means to prevent the accelerated velocity of the preponderating weights when put in motion; and it appears to us, that his manner of finally disposing of this velocity, by letting the caissons souse down into water, is a very rude and inadequate method. We also think, that his using ropes for connecting the caissons, at the different sides of the grooved wheels, is very objectionable, as the changes of the weather would be perpetually altering their length; which would produce serious inconvenience, and cause them to be neither so durable or so cheap, ultimately, by many degrees, as the chains used for the same purpose by Mr. Woodhouse.

We have already mentioned that we consider the reservoirs, for filling with water the under compartment of the boat-caisson, to be superfluous, and our reason for this is, that the upper level of the canal might be made to serve the same purpose, unless such extreme economy of water were thought necessary on this occasion, as is proposed for the rail-road transferrer. We have, however, less hesitation in thinking the compartment (or, in fact, the fourth caisson) under the boat-caisson, to be unnecessary, since it is very evident that the same effect might be produced without it, by increasing or diminishing the water in the counterbalancing caissons, as might be required for their ascent or descent.

We can say nothing in favour of the application of a water counterpoise for transferring carriages, on the different levels of rail-roads, as we imagine that it would be attended with much needless expense and complication for an operation, that may be performed much better by inclined planes and *dry* machinery. A water counterpoise may, however, we think, be used to advantage instead of a crane, as proposed by the patentee, though his method is far from being the best for the purpose. *Ib.*

*To John Hague, Engineer, for his having invented certain improvements in the method of expelling the Molasses or Sirop from Sugar. Enrolled December*, 1828.

There are two modes proposed by the patentee of extracting the molasses or sirop from sugar; the one is by producing a vacuum or exhaustion of the air under the sugar, by which the weight of the air above will be enabled to cause the liquid part to precipitate through, and leave the sugar dry; the other is by condensing the air above the sugar, and by its mechanical force producing the same effect.

Various forms and constructions of apparatus may be applied to this purpose, and the patentee, therefore, does not confine himself to any one in particular, the improvement consisting in the employment of a false bottom to the pan or vessel in which the sugar is to be operated upon.

This false bottom is to be made of copper, with perforations all over it like a colander, and placed a few inches above the real bottom of the vessel; upon the false bottom a straining cloth is to be laid, and the sugar spread a few inches thick upon the cloth.

The lower part of the vessel below the false bottom being air tight, a pipe from an air pump is to be introduced into the vessel under the false bottom, and the pump being put in action by any convenient means, as by a hand level, or by connexion to a steam engine or water wheel, the air between the false and real bottoms will be drawn out, and a vacuum thereby produced. The pressure of the air above will then cause the molasses to pass through the sugar, and through the straining cloth, and having descended through the perforations to the bottom of the vessel, may from thence be occasionally drawn off by a pipe, with a cock inserted into the bottom of the vessel, leaving the dry sugar above.

It is unnecessary to describe the construction of an air pump, as that is well known, and a vessel of any convenient form with a perforated false bottom will answer the purpose, provided the sugar is so spread as to cover the bottom completely; and the operation will be further promoted by occasionally sprinkling a little water, or water impregnated with lime, upon the upper surface of the sugar.

The upper part of the vessel being closed, an air pump may be employed to force in a quantity of air, which becoming condensed above the surface of the sugar, will force the molasses and other liquid parts through the sugar into the lower vessel, as above described.

Either of these operations may be performed, or both may be brought into action together, and the molasses will by these means be more effectually extracted from the sugar, than by any other process heretofore employed.—(London Journal.)

COMMUNICATION.] [FOR THE MAGAZINE.

## FILTRATION UPWARDS.

MR. EDITOR,—I have not had time to prepare, and serve up to your feast of science, those little trifles which I promised you some time ago. I have been moving, and dont know where to find my minutes and memorandums; but as we can always display our own feats without the help of documents, I will draw on this inexhaustible fund for a page to your valuable Magazine; which will then appear to me still more valuable.

Fashions are said to move in circles; the arts, perhaps, may sometimes affect the same course, or some other excentrick curve, whose revolutions are so distant, or slow, as to make their reappearance a novelty to the living generation.

The circle we know, has been from the remotest period, a favourite figure; nature delights in it, and adopts it, from the path of the most distant planet, to the revolutions, and renovations of animal and vegetable life, in their minutest forms. The circle in fact, has intrinsick merits of its own; it is a perfect figure, homogenious in its out lines, surpassing all others in capacity, the emblem of eternity, and, like that, refuses to be measured.

Perhaps, what we call superstition, in relation to the popular charm of certain numbers, may rest on a foundation as good as this, if we did but know the origin of that charm. The number three, was a divine number before the Christian era, and is now held in veneration by Christian sects which do not admit the trinity.

But, Mr. Editor, I had almost forgotten what we are least apt to forget, namely, myself; I am to speak of my own inventions, and I have been dreaming about magick figures and numbers. What led me into this train of thought, must have been the known fact, that certain arts do sometimes disappear, and come back again, like the fashions.

A few months since, a friend pointed out to me, in one of the British periodicals, the specification of a new patent for filtering by ascension, with all that easy philosophy, which would naturally occur to any one, who might stumble upon this inverted process of filtration; observing to me, "this is an old acquaintance of yours." To this friend, who has a taste for the mechanick arts, I communicated, about twenty years ago, the manner in which I obtained pure water on board ship, from water that was ropy, and quite fetid. I had my family with me,

and coming from France, I had vegetables packed in sand, and some bags of charcoal for a cooking apparatus; my children could not drink the water; and I first thought of using charcoal, that great and fashionable chymical agent, which was so much in use at that time, amongst the French philosophers. But on reflection, I determined to add something of my own to the process, and to combine chymical and mechanical means together. I took a wooden vessel, and made to it a false bottom, distant from the real bottom about two inches; on the false bottom, which was perforated with holes, I laid a piece of linen, and on that a stratum of sand, then a stratum of pulverized charcoal, and so on, alternate layers, to within about two inches of the top. Between the false, and the real bottoms, I inserted a tap, then fixed in the hole of the tap a hollow reed, upright, and a little higher than the wooden vessel; into this reed I poured the corrupt water, which was pressed upwards through the filter by the superiour elevation of the tube. In about half an hour the water began to appear above the linen that covered the upper stratum of the filter, perfectly pure and limpid, I drew it off by means of a quill inserted near the top. My invention was much appreciated by the passengers, and I had more customers than I could satisfy.

Some years after this, being in Washington, I heard Mr. Brown, then a senator from Louisiana, speaking of the water of New-Orleans, as being turbid. I then told him of my combined ascension filter, and proposed for his consideration, a plan for filtering the water of the Mississippi, on a large scale for the city. The plan was as follows:

To sink cisterns about 10 feet below the surface of the water in the river; construct false bottoms of wood, brick or stone, perforated with small holes; on these bottoms lay a stratum of coarse gravel, six inches thick, then a succession of strata, of the same thickness, but diminishing in fineness to the finest sand. The top of this filtering mass should be covered with a perforated cover, one foot at least below the low water mark of the river. The water was to be introduced into the bottom of the cisterns, by a leaden pipe; and to avoid the necessity of cutting the levee, or dike, too low, I proposed to apply the syphon principle; the leaden pipes, acting as such, and being once charged, would continue to flow so long as the water of the river was higher than the upper covering of the cisterns. The leaden tube might be placed inside or outside of the cisterns. For the convenience of cleaning the cisterns from the sediment, it was proposed to have a small man-hole from top to bottom.

The philosophy of my invention was this: It is known that the deposition of sediment, from fluids, is in the combined ratio, of their specifick gravities, and the quiescent state of the fluids. When the deposing matter is nearly of the same gravity with the fluid, the least agitation will bring it back from the bottom, and keep it in motion; therefore, the most perfect repose is necessary for the deposition of many particles which adulterate water. I concluded then, that as soon as the fluid came in contact with the under surface of the false bottom of the cistern, it must be perfectly still, and the deposit would be the more rapid, and increase, perhaps, with the increased resistance which would be met in ascending through a denser medium. By this arrangement I presumed that the filtering mass would not be soon saturated; for most of the heavy particles in the water would receive a direction downwards, before the water had time to penetrate beyond the perforated false bottom, and many of the lighter particles would adhere to the under surface of the false bottom till the more perfect depuration of the water below, should allow them also to descend.

If I am not deceived, a filter on this plan may be easily made which would make hard water soft, by depriving it of those calcareous particles which furze up our tea kettles and, perhaps, leave dangerous deposits in our bodies. The open order of the filter, occasioned by the gradation of coarseness in the gravel, downwards, would enable it to be rinsed, by stopping the flow of water, taking out what water was in the cistern, and then throwing pure water over the upper covering; but still better, by taking off one or two of the upper strata of sand.

I am not aware that this plan was ever adopted; the gentleman to whom it was suggested, went soon after on a foreign embassy, and did not, I believe, return to New-Orleans.

In 1812 or —13, I applied the same principle, with some variation, to clarify wine. The variations consisted in applying force, instead of the simple pressure of a head of liquid, to drive it through the filter, but still upwards. My first experiment was on some turbid red wine. I used

for that purpose a glass tube, with a plunger to force the wine through a compound mass of cotton, sponge, sand, charcoal and burned clay. The wine came through clear, but with the loss of a part of its colour, and much of its flavour. I did not pursue my experiments, although I was convinced, that with a proper selection of materials, and a judicious application of force, that any liquor might be made fine, instantaneously, and without injury. I had made, however, a tin vessel some time after, for filtering coffee, on the same plan, which remains now unfinished, in consequence of that versatality which so proverbially, and so justly attaches to dablers in the arts. What has brought this subject back to my mind, is the annunciation in some of our late papers of a process of filtration, which, it is said, will separate the salt and other offensive ingredients from the water of the sea; and also extract the colouring matter from ink, and other liquids. The mode of producing this effect, is not stated, but I am inclined to think, that it must be somewhat similar to the process described above; and I am very glad to learn that some one has had the patience and perseverance, to perfect that which I had only began. I believe that I threw into one of our papers, a short notice of my project; if so, and I have been the means of aiding in a useful invention, it is as much compensation, as usually falls to the lot of schemers.

I am not acquainted with the process of straining oil, but I should think that the mucilaginous and heavier particles, might be separated from the oleaginous, by means similar to those described above, with or without the addition of some chymical, and purifying agent. If so, the most impure and common oils, may be rendered fit to burn, and perhaps for other purposes.

I am just now informed, that a part of the city of London is supplied with the water of the Thames, filtered on the plan of the late patentee: so that the merit of my invention, as proposed to Mr. Brown, has been fairly tested.

I shall at some other time, propose a cheap, and easy application of this principle, for filtering water from the publick reservoirs, for culinary purposes. The reservoirs would be thus multiplied, and the fire department would have more, rather than less water. I may be allowed to take some liberty with the reservoirs, as I claim some relationship to that improvement.

[The patent of John Hague, the account of which precedes the article on filtration, appears nearly allied to the latter, depending on force to separate the constituents of certain bodies. The patent for extracting the molasses from sugar, probably grew out of the patent, taken lately in England, for filtration upwards, which depends also on force; therefore we think we may fairly claim the priority of discovery, for our country, of the principle on which they both rest.—EDITOR.]

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(From the London Mechanicks Magazine.)

Notes of a course of Lectures on Mechanicks, delivered by Dr. Lardner at the London University—Session 1828-29.

Previous to entering into the science of mechanicks, it will be necessary to explain a few of the properties of bodies.

*Cohesion* is that property by which the several particles of any substance, &c. are kept united, and without which there would be no difference in the natures of bodies. All the various phenomena of a body, being tough, hard, soft, &c. are the effects of a greater or less degree of cohesion. Some bodies have greater intensity of cohesion, in proportion to the magnitude of their spheres of action, than others. For example, if a piece of iron be drawn asunder (which will require an immense force) it will be almost impossible with any weight to unite the pieces, however large may be their spheres of action, shewing that the cohesion is but small; while a piece of India rubber may be stretched out to a great length, and, if broken, can easily be joined by pressure, though the sphere of action be but small; by which it may be easily seen how much stronger the cohesion is in India rubber than in iron.

Cohesion exists not only between materials of the same kind, but also between those of different kinds, as between solids and liquids, &c.

There is another kind of cohesion called *capillary attraction*, which is a propensity that water or any other liquid has to ascend in small tubes, as the pores of sponge, &c. The cause which produces this effect has occasioned great dispute; but the investigation of the merits of each opinion is too much mixed up with mathematicks for the present course of lectures. An illustrative and amusing experiment may be tried by immersing one end of a piece of thick cotton in a glass of water, and letting the other end hang down on the outside, when the glass will be emptied in a short time.

*Impenetrability* is an universal property of matter, and susceptible of no degrees.

*Example.*—Suppose two cannon-balls were proceeding towards each other with the same force and velocity in opposite di-

rections, if they *were* penetrable they would pass through each other and continue their courses; but this is impossible, and therefore they are impenetrable.

The *pores* of a body are the interstices between the particles which constitute the mass or quantity of matter; and it is by the closeness of these particles that the different degrees of *density* are formed. Thus, the denser a body is the fewer pores it has. If a tube be half filled with water, and then *gently* filled up completely with sulphurick acid, after shaking them together, the mixture will be found to have diminished considerably, which may thus be accounted for: —The particles of the sulphurick acid being less than those of the water, when mixed together the former occupy a great part of the space previously held by the pores of the water, in the same manner as a mixture of shots and bullets will occupy less space than the two separately. Silver and copper, when mixed, will produce the same effects; and many persons have been deceived, in mixing spirits and water, by the same phenomena resulting.

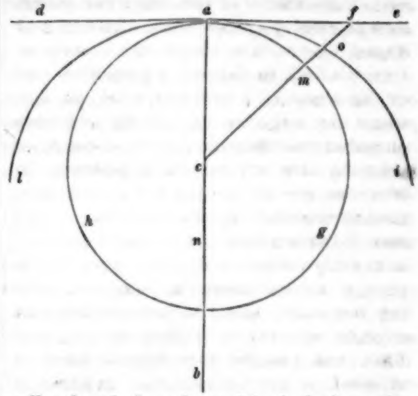
The *volume* of a body means its pores included with its particles.

There are many curious examples of the property of *divisibility*, which may not be uninteresting. If a pound of silver be melted together with a grain of gold, every grain of the mixture will contain a visible particle of the gold, which may be detached by means of aqua fortis; consequently, one grain of gold may be divided into 5761 *visible* parts. A grain of musk may be placed in a room where the air is continually being changed, and at the end of 20 years no sensible diminution of bulk will be discovered, although it may be supposed that particles of it were constantly flying off to scent the air. Lewenhoek has discovered many other properties which may not be uninteresting. The size of the animalculæ in water bears about the same proportion to a mite that a bee would do to a horse. The milt of one cod-fish contains a greater number than there are human beings on the earth.

It is in consequence of this property that it is impossible there can be a perfect vacuum in the receiver of an air-pump; for though there are some machines which will extract $\frac{9}{10}$ths of the air contained in them; yet they will be as perfectly filled by the remaining $\frac{1}{10}$th as they were by the whole.

There are two ways of shewing to how great an extent one may imagine this property to reach.

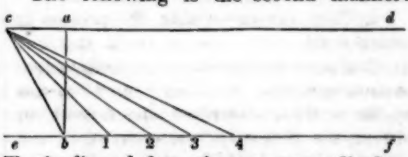
From a point, *c*, in a straight line, *ab*, de-




scribe the circle *agh*; to this circle draw the tangent *de*, and from the centre *c* draw the line *cf*, which is the line wished to be divided, and which is cut in the point *m*.

Now, from a point *n*, still lower in the line *ab*, describe another circle *ail*, touching the tangent in the same point *a* as the other one did, and the line *cf* is again cut by this circle in the point *o*. Therefore, the part *f o* is evidently less than *fm*. Now it is evident, that by increasing the radius of the circle, it shortens the part of the line *cf* cut by the circle; and as no bounds can be given to the length of this radius, so there are no ends to the divisions of the line *cf*.

The following is the second manner:




To the line *ab* draw the two perpendiculars *c d* and *e f*, and along the line *b f* mark off even spaces as at 1, 2, 3, 4, &c., and from the point *c* draw the lines *c*1, *c*2, *c*3, *c*4, &c. Now it is evident that the line *c*2 cuts the line *a b* at a point nearer *a* than the line *e*, and *c*3 nearer than *c*2, and *c*4 than *c*3, &c.; and as *c d* and *e f* are parallel, the lines *c*1, *c*2, *c*3, *c*4, &c. may be continued to infinity, and each *succeeding* line will approach nearer to the point *a* than the *preceding* one, but will never touch it.

The expression "*infinity of division*" must not be confounded with "*infinity of divisibility*;" the former means that degree of infinity which may be attained by *real* measurement, while the latter implies that to which there are no limits attached.

Previous to concluding this subject it may

be entertaining to describe Dr. Wollaston's ingenious manner of procuring fine wire for astronomical purposes—for ascertaining the distance between any stars, &c.; on the accuracy of which depends all the perfection of the study of astronomy. It had been found that when the very finest thread was placed across the end of a telescope, it was magnified beyond the star's apparent size, and consequently hid it from view; for although the stars appear very large when seen with the naked eye, yet this is the effect of radiation alone; and a star when viewed through a good telescope, is nothing but a brilliant point. Dr. W.'s manner of obtaining the wire was this:—He procured a slender cylinder of silver, through the axis of which he drilled a hole, the diameter of which was $\frac{1}{10}$th part of the silver; this hole he then filled with platina; the whole wire was then drawn until the entire diameter was no more than the $\frac{1}{300}$th part of an inch; consequently, he had a wire of platina within the silver equal to the $\frac{1}{3000}$th part of an inch in diameter; and this he disengaged by immersing the whole in nitrick acid, which precipitated the silver, and left the platina unaffected.

It is supposed that all matter is composed of elementary monicules, which are quite hard and infinitely minute, and of which there are three things to be observed.

1. No particles are in actual contact with each other.

2. They are so minute as not to be distinguishable.

3. They are indestructible by human or natural agency.

To prove the first property it need only be shown that a body is compressible, for it cannot be said that the particles themselves are compressed. Thus, when a piece of metal is contracted by cold, the weight remains the same, although the size is different. It is the pores, or spaces between the particles that are contracted.

The second property can easily be imagined, by reference to the description of divisibility before given.

The third property is indestructibility.—It has been very justly and truly observed, that "It is as impossible to annihilate one of the particles of which a body is composed, as to form one, and there is not one single particle less in the world now than there were at its creation." The whole power of man consists in making three changes in matter, viz. by combustion, separation, or evaporation. Thus fuel is changed by combustion, some of the particles escape up the chimney in the form of smoke, (and are dispersed over the earth to conduce to the use or pleasure of man,) others remain in the chimney in that of soot, while the rest fall in ashes below, or are dispersed about the room as dust.

All substances or materials are divided into three kinds, according to their different strengths of cohesion.

1. When the cohesion of a body is so much stronger than its repulsion as to keep it in a firm position, it is called a solid.

2. When the cohesion is equal to the repulsion, or the difference between them on either side is very small, it is a liquid.

3. But if the cohesion be much less than the repulsion, the particles will actually repel each other, in which case they are called gases.

Every thing in nature may be classed under one of these three heads, with only four exceptions, viz. heat, light, electricity, and magnetism; the study of which is too abstract to be treated of in the present course of lectures.

A solid is the only class required to be understood in mechanicks; the other two classes of substances form distinct sciences.

The word solid has three distinct meanings.

*In Geometry*, it stands opposed to superficies, and signifies that which has three dimensions, viz. height, length, and breadth.

*In Mechanicks*, it has the definition before used, and in which sense only it will be now used.

*In Metaphysicks*, it means any thing which occupies a space, or which must be removed before any other substance can occupy the same space. In this sense air is a solid, as may be proved by plunging an inverted glass into a vessel containing water, which cannot enter the glass until the air is displaced.

With regard to a solid, the first property to be considered is inertia, which may be described as a total absence of activity, an incapacity of any spontaneous action. It is a principle that must be evident to all. It is not a body itself that is inert, but every particle of it is so. There are four kinds to be proved,

1. If a body be at rest it cannot put itself in motion.

2. If a body be in motion it cannot alter its direction or increase its motion.

3. If a body be in motion it cannot stop.

4. Nor diminish that motion.

In illustration of the first definition, it may be observed, that a mass of matter in a state of rest will remain so for ever unless acted upon by some force. It is impossible to imagine that a stone or other substance could move by itself. Now, it can be proved that every other definition can be resolved to this first one.

Second Definition. If in motion, a body cannot increase that motion. Let a body moving with a given velocity suddenly increase at any given rate, say two miles an hour, the same extra force must have been used then which would have moved a body (at rest) two miles an hour, but as no force was used, it would have moved contrary to the first definition. Neither can it alter its direction. In this case the only difference consists in the extra force being exerted in a lateral direction.

Third Definition. If in motion a body cannot stop, then it would require the same force in an opposite direction.

Fourth Definition. If in motion, a body cannot diminish that motion, for the force which when applied against a body in motion, would diminish that motion, would, if it acted upon a body at rest, move it with a velocity equal to the diminution, and which would be contrary to the first definition.

There are three distinct data to be considered, viz. the application, the direction, and the quantity or velocity of a force, all of which are essential.

The property of the third definition of inertia, viz. an inability to stop when in motion, may be shewn in many familiar effects. Stages when they are running with a certain velocity, give the same to the passengers, and when the coach stops suddenly, the passengers would be thrown off were they not prepared. It is in consequence of this property, that a person can leap further by taking a run before doing so; the impetus is gained by the run.

All bodies, as far as have been tried, have inertia, consequently, we may suppose it an universal property of matter. Now, this supposition is made by virtue of what is called mechanical induction, in contradistinction to physical induction, for which, before any conclusions can be drawn, every particle of matter must be tried on. Thus, before it can be said that sand is inert, experiments must be tried on every single particle of the sand; but it is otherwise in mechanical induction, for there, if inertia or any other property be discovered, in all bodies on which experiments have been made, it is assumed as universal.

It must be remembered that there are two kinds of rests, distinguished by the names of absolute rest, and equilibrium; the former produced by its inertia, and the latter by the neutralization of forces exerted in different directions against the body.

Force is whatever produces or tends to produce motion in a body.

There are two classes of problems derived from the effects produced by the influence of several forces. When under the influence of several forces, a body will be either at rest or it will move. If at rest, the forces must neutralize each other's effects, and the body will be in equilibrium. The study of this branch of forces is called staticks, and its object is to investigate what forces will keep a body in equilibrium. But if these forces do not neutralize each other's effects, it forms another problem in mechanicks called dynamicks, when a certain number of forces are given in different directions, to determine what will be the position of the body on which these forces act.

(To be continued.)

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COMMUNICATION.] [FOR THE MAGAZINE.

## IMPERIAL GALLON.

Mr. Editor,—A correspondent, "Meter," in your last Magazine, wishes to know the number of cubick inches in the *Imperial Gallon*. To give him the information he desires, I have extracted, from an English work, the following act:

"*And be it further enacted*, That from and after the first day of May, one thousand eight hundred and twenty-five, the standard measure of capacity, as well for liquids as for dry goods, not measured by heaped measure, shall be the gallon containing *ten pounds* avoirdupois weight of distilled water weighed in air, at the temperature of 62° *Fahrenheit's* thermometer, the barometer being at thirty inches, and that a measure shall forthwith be made of brass, of such contents as aforesaid, under the direction of the Lord High Treasurer, or the Commissioners of his Majesty's Treasury of the United Kingdom, or any three or more of them for their time being; and such brass measure shall be, and is hereby declared to be, the *imperial standard gallon;* and shall be, and is hereby declared to be, the unit and only standard measure of capacity, from which all other measures of capacity to be used, as well for wine, beer, ale, spirits, and all sorts of liquids, as for dry goods not

measured by heaped measure, shall be derived, computed, and ascertained; and that all measures shall be taken in parts or multiples, or certain proportions of the said *imperial standard gallon*, and that the quart shall be one fourth of such *standard gallon*, and the pint shall be one eighth such *standard gallon*, and that two such gallons shall be a peck, and eight such gallons shall be a bushel, and eight such bushels a quarter of corn, or other dry goods, not measured by heaped measure."

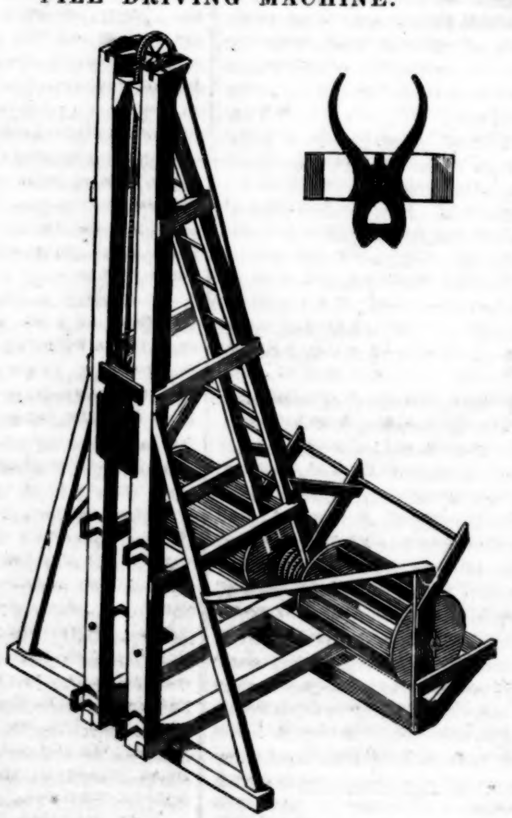
"The absolute weight of a cubick foot of distilled water at 62° temperature is 62,321 pounds, according to the new imperial standard." (See Farry on the Steam Engine, page 75.)

From this we find a cubick inch to weigh .0360653 of a pound. Then, as the imperial gallon weighs 10 pounds, if we divide 10 by .0360653, we shall have 277,274 *cubick inches in the gallon.*

E.

COMMUNICATION.] [FOR THE MAGAZINE.

## PILE DRIVING MACHINE.



Mr. Editor,—The London Mechanicks Magazine of January and February, 1830, contains a description, and a number of engravings, of various kinds of pile driving machines. Being unwilling to see our English brethren triumph over us, in all that relates to the arts and sciences, I have sent you an isometrical projection* of an improved pile engine. This is an application of the tread wheel instead of the crank. Something similar to it, was first used at the building of the Boston and Roxbury Mill Dam, about the year 1819, but has not from that time, till within three or four years since, again been brought into use. There

* Some account of this useful method of drawing, invented by Professor Farish, may be found in Dr. Gregory's Mathematicks for Practical Men.

has been four or five of these machines in operation at the Dry Dock, Charlestown Navy Yard, since the commencement of that important work; and I have frequently seen them on the new streets near Charles River bridge. It is found that eight men on the wheel, with one overseer, whose duty it is to keep the pile in a perpendicular direction during a few of the first blows of the ram, will do one third more work than the same number can on one of the best constructed machines with a crank; that is to say, those on the former, have arranged nearly 14 piles of 8 to 12 feet in length in a day, while those on the latter were not able to drive more than 9. The ram of the machine from which this drawing was taken, weighed about 2005 pounds. The nippers, or tongs, were constructed in a better manner than those described in the London Mechanicks Magazine. The arms, or parts which slide between the inclined planes, were nearly three times the distance of the lower ends from the fulcrum or centre of motion, while in the English ones they are very nearly equal. When the ram arrives at the top of the machine a vast deal of friction takes place; so much so, that the men are obliged to exert a great force to disengage it. It is clearly evident that in the first case, there being a greater lever power the pincers may be separated by a much smaller force than in the second. Most people have an aversion to the tread wheel, because it is employed in England and other countries as a mode of punishment, imagining its use to be to tire and weary the criminals; but this is not the case in regard to this application of it, as the men have a chance of resting a few seconds every time the ram drops, and I have heard workmen who have been accustomed to this machine say they decidedly preferred it to any other.

The parts of this engine may be so easily understood from the drawing that they will need no particular description.

E.

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COMMUNICATION.] [FOR THE MAGAZINE.

MR. EDITOR,—The writer of the remarks upon the statute of 1819, chap. 154, in your May number, seems to have set out with a determination to be pleased with nothing, and to find fault with every thing; and so far, he has faithfully executed his purpose. If his object was to aid the mechanicks and contribute to the passing of a perfect statute, upon the subject to which said statute relates, it is much to be regretted that he did not give the form of what he thinks a perfect statute, after pointing out, in a very loose, indefinite manner, what he considers defects in the present. Had he done this, from the tenor of his remarks, more especially as to the remedy, I am apprehensive we should have had the form of a statute much less perfect and useful than the present, whatever may be its defects. The writer of said remarks is so apprehensive that the ninth article in the bill of rights, which is not very definite, will be infracted by the statute of which there is no danger, that the positive provisions of the fifteenth article are overlooked. And from his observations upon the form of the process, provided by the present statute, I presume he would have left the aggrieved party to his action at common law, or prescribed a statute remedy, more inconsistent with the ninth article, than the one given by the present statute.

Before the statute of 1819 was passed, it had often happened, and some prominent cases were in view when it was made, that a brick-maker made a contract with the proprietor of a lot of land, (or the owner of it, in fee simple, if the writer prefers it,) to furnish bricks for a block of houses; a mason, to lay them; a lumber-merchant, to furnish the lumber; and a carpenter, to work it up; and, neither of them having been paid, some other more wary creditor of the owner of the land, attached it, with the buildings thereon, and secured his debt, from the property and labour of others; reaping where he had not sown, and gathering where others had strewed. Mischiefs like this, I presume, the legislature which passed the statute, intended to remedy. Whether the members of the legislature which passed the statute, were "material" men, and without ethereal spirit, or whether the writer of the remarks, though an ethereal man, has committed many "material" errours and mistakes, the publick must judge.

With his satire on the common law of England, or that part of it which our ancestors brought with them to this country, and considered as their birthright, and their reasons for adopting it, I have nothing to do; nor with the question, whether it is useful or absurd to consult English decisions as to the construction of statutes and contracts. However, the wisdom of those, who think themselves too

wise to learn any thing from others, generally is foolishness.

The object of the statute, I presume, is rightly described. Its purpose, undoubtedly, was to establish a new remedy for certain contracting parties, and to do it in such a manner, that the rights of third persons should be secured. This, in my mind, is effectually done, and in the cheapest possible mode. Perhaps when I see the form of a statute, which may be produced by the author of the remarks, I may alter my mind. The present statute is said to be "ambiguous, intricate, perplexing, badly drawn up, and calculated, from its uncertainty, to do much harm." In what is it ambiguous, intricate, perplexing, or uncertain? In my mind, he that runs may read, and he that reads, may understand it.

The writer of the remarks says, there is, in the outset, an uncertainty as to the personality of the parties. One party, he says, in the first place, is called the *proprietor or proprietors of land;* and that this would, to a common understanding, appear certain enough. But that he is told, that the term proprietor is not sufficiently certain, and that the proprietor of the land may be a very different person from the proprietor of the buildings. He does not say who told him so; but, certainly, it could not be any lexicographer of reputation; nor could he have come to such a conclusion by consulting the statutes of the Commonwealth, ancient or modern. Webster, in his dictionary, defines proprietor, to be a person, who has the legal right or exclusive title to any thing, whether in possession or not. Copy rights to books, are claimed as the right of proprietors, and so recorded; and nothing subjoined to show the extent of the claim. The statutes of the Commonwealth speak of proprietors of land, as owners, *in fee.* To the term proprietor of land, the addition, *in fee*, is never subjoined. By the statute of 1783, chap. 39, the proprietors of lands and wharves, which lie in common, are authorized to levy taxes and raise money; to improve their estate, and to sell the share of any proprietor, who neglects or refuses to pay the tax assessed on his share. Proprietor, *in fee*, is never mentioned. Proprietor and owner, *in fee*, are convertible terms. Does the writer of the remarks believe, that sundry persons, who were tenants, in common, of an estate for six months, would come within the meaning of the term *proprietors*, and that the remedy, pointed out by this statute, would be applicable to them? The land of non-resident proprietors are ordered, by law, to be sold for the non-payment of taxes. Does proprietor, in this case, mean an owner, for a year, or an owner in fee? Notice of the sales, in the above mentioned cases, by law, is to be given, by publishing in a newspaper, which the writer of the remarks has just discovered, is no notice at all. The *proprietor* of a lot of land, and not another person, is the owner of the buildings which stand upon, and are affixed to it. An ancient statute gives the abutter upon the sea, or salt water, *propriety* to low water mark. This has been considered, for more than a century, as giving an estate, *in fee.* It never entered into the head of any person, except the writer of the remarks, that *propriety* meant any thing less than an estate, *in fee*, or that proprietor imported any thing less than owner, *in fee.*

Let the same hypercritical spirit be indulged, and the same liberty taken in suppressing some parts of a statute and distorting the rest, which the writer of the remarks has practiced, and a statute, however clear and consistent, may be made to mean any thing or nothing; and, in its parts, be made consistent, or inconsistent; sense, or nonsense. He says, "We find in the third section, in two instances, the proprietor of land assumes the name of owner of such estate." The makers of the statute expected, and reasonably, that every person would find that the proprietor of a lot of land, mentioned in the first section, and the owner of *such estate*, mentioned in the third, were the same person. It is not surprizing that he should find this, though it is somewhat unconnected; that he should own it, as his object seems to be, to create confusion and raise difficulties. Let the third and fourth sections be taken in connexion with the other parts of the statute, and it is impossible that any person, in the fair exercise of his reason, and who construes them by the rules for construing satutes, or by the rules of common sense, can mistake their true meaning. The third section provides, that any person having a lien upon any building and lot of land, on which it stands, *as aforesaid*, may petition, &c. Can any one doubt what a *lien as aforesaid* means? In the first section it is shown who may have a lien, and how one may be acquired. A person, having a lien, *as aforesaid*, must mean a person who by a contract with the proprietor of

a lot of land, had agreed to build a house or other building, had got his contract recorded, and performed labour or furnished materials pursuant to it. And the owner of *such estate*, is to be notified to appear, &c. The owner of what estate is to be notified? Certainly the owner of the lot of land, on which the petitioning creditor claims to have a lien. No other estate, than the lot of land on which a building had been erected, had before been mentioned; and the words, *such estate*, must necessarily refer to the lot of land, &c.

From the tenor of the remarks, I should suppose that the writer held it to be necessary, whenever allusion was had to the land mentioned in any contract, or to either of the parties, that it must be done with all the particularity which was used in the first description, and that it was inadmissible to use the words, *such, as aforesaid*, &c. This is against the rules of correct pleading, and convenience in practice. A long train of propositions are often designated, *by the premises;* and the whole course of a legal process, the pleadings, verdict, &c. are all comprized in the four words, *such proceedings were had.*

It is much shorter and more convenient to write lien creditor, having stated before what would constitute one, and to say, such estate, one lot of land, or one estate only, having been mentioned, than to describe the creditor or the estate in detail.

The terms, lien creditor, respondent, legal process, &c. seem to be very obnoxious to the writer of the remarks, and are quoted and italicised with much sneering attention. In this particular, a degree of quibbling is discovered, not often witnessed. Did he never before hear of a legal process, or of a respondent? I would ask him, what he would call a person who was summoned to answer to another, in court, not in a certain plea, but, for example, to a libel, for a divorce, or a petition for partition? If he will look into the records of the Supreme Judicial court, he will find the appellation, respondent, not of unfrequent occurrence. Did the writer never hear of an attaching creditor, a bond creditor, or a simple contract creditor? Having shown in the statute what shall give a creditor a lien, why not, for brevity, call him a lien creditor, rather than give him, over and over again, a detailed description. The term, *legal process*, seems to be very exciting; and for this, it is easy to account. The process, mentioned in the statute, is pointed out with clearness, and is calculated to bring all the parties interested before the court, at once, and have justice done promptly, according to the ninth article in the bill of rights, which he thinks is in danger. And there is not the least difficulty in carrying the provisions of the statute into execution. The jury will have no higher or more difficult duties to perform than falls to their lot every term of the court. Vice-chancellors, masters in chancery, &c. will be no more wanted for jurors in settling the claims of the creditors than they are in trying a simple action of assumpsit on an account annexed. Though the claims of half a dozen creditors may be to be passed upon, the entry of but one petition will be to be paid for, and but one bill of costs taxed; whereas, in the mode which, in the view of the writer of the remarks, is so much more preferable than the statute remedy, six writs, six entries, and all the train of items, in a lawyer's bill of costs, would be to be paid for; and if the fund was not exhausted, the lien creditors, (or rather *lean* creditors,) could share only the pitiful balance. The court will find more *relief*, in having six causes consolidated into one, than in getting the respondent before them, by whatever name he may be called. What mighty difficulties will attend the execution of this statute proces? None, except in the imagination of the writer of the remarks. The necessity for interpleading, and for vice-chancellors, masters in chancery, for jurors, does not exist, out of his mind. Is it not as easy to ascertain the balance of A's account against B, C having an account against B, as it would be if C had none. It will take longer to try six demands, if they are litigated, than to try one; but it will take much less time to try them by one jury, in a consolidated trial, than by six juries, in six several actions. By our statute of set-off, two independent demands are tried in one action. If two can be tried by a *common* jury, why not three, or six? We have a statute which authorizes after-attaching creditors to come in and defend against the demands of a previous attaching creditor; and I have never heard that a jury of vice-chancellors were found necessary.

By another statute, an action of contribution is given to a devisee, whose estate is taken to pay a debt of the testator, against the other devisees and legatees; and as often as a suit was brought before the court, upon that statute, before equitable

powers were given to the court, they expressed deep regret, that they could not bring all the devisees and legatees before them at once, and do justice to all, by one process. This statute gives the court the powers which they needed, and which they regretted they had not; and of this, the writer of the remarks complains. The writer of the remarks, probably, is a practicing lawyer. The remedy prescribed by the statute is much more expeditious, and much less expensive than the common law remedy; but will be much less productive to a gentleman of his profession. To have but one process going on, under the statute, when there might be a dozen at common law, is a melancholy thought. It will not delight those who thrive best where suits are multiplied and fees abound.

The trial by jury is very significantly italicised and quoted. The fifteenth article in the bill of rights, gives the right of a trial by jury, in all controversies respecting property. But the statute does not limit the parties to that mode of trial. An issue in law may be tendered to the court, and the cause tried in any legal mode, "otherwise" than by a jury.

As though nothing was to be permitted to escape censure, the provision respecting the recording of the contract, is criticised.

When a deed between two or more parties, consisting of two or more parts, in order to make it effectual, must be recorded, it has been made a question, whether one party getting the part recorded, which he held, would avail the other party, who did not get the part of the deed recorded, under which he claimed, and which he held. How unfair the remarks of the writer are on this provision! Any one would suppose, from the remarks, that the statute provided for recording one half of the contract, and not the *whole* of one part.

The writer of the remarks is so much alive on the subject of the statute, that he is startled at a "whisper." Some sage person has disturbed his quiet, by "whispering" in his ear, that a part of the mechanick's claim may be in danger; and he asks whether the statute remedy is cumulative. Whether the lien of a mechanick is created by such a contract, or a mortgage, I conceive is immaterial. It has always been held, when the mortgaged estate will not pay the whole demand, for which it is mortgaged, that the mortgagee could maintain an action against the mortgagor, for the balance.

The writer of the remarks does not quarrel with the principles of the statute. His whole force is spent upon the details of it; and he hopes that the system may be reformed; not in part, but altogether. If he is heard from again, on this subject, he is requested to furnish the form of, what he thinks, a perfect statute; and if, on examination, I think it preferable to the one which now exists, I will use my own exertions, and all my influence with my brother members of the legislature, to effect a repeal of the present statute, and speed the passage of the bill which he may furnish. It is easy to find fault and raise objections against the detail of a statute; and he that does it, ought to give those which are better. Considering the present statute as a ship of some sort, he cannot tell what, he thinks she must be rigged by lawyers, before she will be sea-worthy. If the writer of the remarks has the rigging of her, he will purpose her for long and moderate voyages, and a great many of them; and have her well provided with sails, in the form of fees. And he is, probably, now contemplating, under a new statute, that six long writs will be to be filled, instead of one short humble petition; and that he will put six bills of cost into his pocket, instead of one. And whatever the new ship may be called, brig, schooner or smack, he will "smack" his lips in expectation of extended litigation and more fees.

There are other cavilling, unfounded objections to various provisions in the statute. While the writer of the remarks charges the framers of it with forgetting, in making one section, what they had done in another, he is emphatically obnoxious to the same remark. He says that the fifth section provides for the payment of the attaching creditor's debt in full. No such thing. The fourth and fifth sections, taken together, exclude any such conclusion. The statute has provided, that previous to the sale of the estate, such notice shall be given of the time and place of sale, as is provided, *by law*, when the right of redeeming real estate is sold, which has been conveyed in mortgage. For want of the words, *on execution*, after the word *sold*, he says the whole is uncertain, and open to conjecture. Has the law provided for giving notice of the time and place of sale of any such equities of redemption, excepting those which are sold *by execution*? If it has, it is unknown by me. If it has not, where is the uncertainty? Giving time for

redeeming an estate which has been sold, is mentioned as cause of complaint. To have omitted this provision, would have been unprecedented. So prone is the writer of the remarks to complain, that, though he considers it a grievance that the creditor is delayed, a year, in the receipt of his money, with the chance of starving. He censures the provision which secures him compensation for the delay.

The statute provides that *the officer* who made the sale, &c. shall ascertain the value of such lot, &c. at the time when it was attached. It is now gravely asked, what will take place if, during the two or three years, which may reasonably be supposed to intervene between the *appraisal and the sale*, the officer who made the *appraisal* should die? Could the sale take place? The provisions of the statute are strangely misapprehended by the writer of the remarks. The provisions of the statute are, that the sale of the estate shall be made, when the court order a sale, by the sheriff or his deputy; and that the *officer* who makes the sale shall cause it to be appraised, &c. The estate is first to be sold; and before distribution of the proceeds between the attaching creditor, (when there is one,) and the other creditors, an appraisal is to be made. How can it, *reasonably be supposed that two or three years will intervene between the appraisal and the sale?* It might as well be supposed that three years would intervene between the seizing of a lot of land, on execution, by the sheriff, and the setting it off by the appraisers. But suppose such length of time should run, and the man who was sheriff, and made the sale, should die before the appraisal of the land and a completion of the business, what then? Could not another man be appointed sheriff? And cannot an after sheriff do what a former sheriff has left undone? Such *officer* is to do such acts, and not such person. Such a critick, as the writer of the remarks, will make any thing a "hermaphrodite."

A Friend to Mechanics.

As our pages are always open to free discussion, we readily give place to the above remarks upon the article which appeared in our last, and invite the attention of our readers to the subject, as highly important. We do not, ourselves, feel competent to pass judgment upon the merits of this question; but we believe that with such aid and information as can be obtained without fee or reward, each one will be enabled to judge for himself. We deplore the present fashion of accompanying every inquiry after truth with personal remarks; but we must give our readers the tares with the wheat, and leave to them the task of separation.—Ed.

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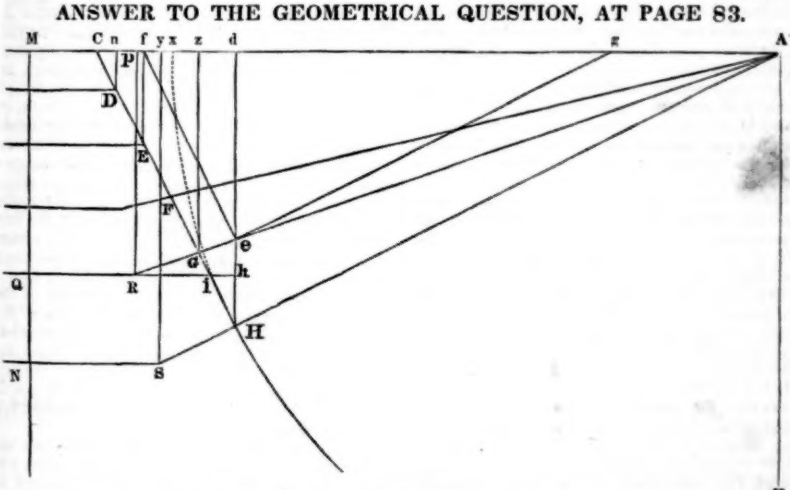
COMMUNICATION.] [FOR THE MAGAZINE.

## ANSWER TO THE GEOMETRICAL QUESTION, AT PAGE 83.




Through the points H, S, G, R, draw lines perpendicular to the line ACM.

AM = Ax + xM. AM — NS = Ay.

In the right angled triangle Ay S, $\sqrt[2]{Ay^2 + yS^2} = AS$.

The right angled triangles ASy and AHd being similar, we have AS : AH : : Ay : Ad : : Sy : Hd.

Ap = AM — QR, pR = MQ = MN — NQ. Then the right angled triangle ApR gives $\sqrt[2]{Ap^2 + pR^2} = AR$. The right angled triangles ApR and Ade being similar, give Ap : Ad : : AR : Ae : : pR : de.

Through the point e draw ge parallel to AH. Also, ef parallel to HC. The line Hed being perpendicular to the line AM, the two right angled triangles gef, fde, have the angle gfe common to both, they are similar, and the sides are proportional. Also, the two right angled triangles gef, gde are similar. The triangle gfe being similar to AHC, is right angled at e. Consequently, CH : HA : : ed : eg, gd : de : : de : df.

Produce the line QR till it meets the line Hd in h. The two triangles ACG, RGi, have the angles ACG, RGi equal, being vertical angles, and the sides Ac, Rh, are parallel by construction; therefore they are similar.

The triangles Aef, AGC, are similar, because ef is parallel to GC. Hd — QM = Hh. The triangles Hdc, Hhi, being similar, Hd : Hh : : dC : hi : : HC : hi. Rh — ih = Ri. Af : fe : : Ri : iG : : Ae : RG. AR — RG = AG. Then AR : Rp : : AG : GZ : : Ap : AZ. AZ and GZ being the distances sought. It is evident that the perpendicular distances of the point F from AK and AM may be found in the same manner.

To find the distances of the points E and D from AM and AK.

Through the points E and D let fall perpendiculars on the line AM. Suppose these perpendiculars to meet the line AM in the points f and n. Then the two triangles Hdc and EfC are similar, and Hd : dc : : Ef : fC : : nD : nC. Ae — fC = Af, AC — nC = An. Af and An being required.

E.

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*From the Franklin Institute.*

## SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the Percussion Gun Lock, for Fire Arms. Granted to Samuel Forker, Meadville, Crawford County, Pennsylvania, February 13th, 1830.

This improvement consists in the simplification of the percussion lock in the new formation and arrangement of the parts; dispensing with all superfluous fixtures, and reducing the number to six, viz.—the main spring, lever or cock, pivot, dog, tumbler pin, which also serves for trigger, and feather spring.

The main spring is affixed to the side of the barrel, and presses upwards against the lever (which is placed horizontally on the top of the barrel,) close behind the pivot. The lever is about two inches in length, with a concave hammer or a point, according as it is wanted for the percussion cap, or the grained percussion powder. It is let down into the pivot post, which stands perpendicularly on the side of the barrel, and is confined to its place, by a pin passing through it, about three fourths of an inch from the hammer. To the hinder extremity is fastened the tumbler pin, passing perpendicularly through the stock behind the breech, and which is provided with notches, which when the end of the lever is pressed down, take hold on a dog affixed to the end of the breech. When cocked, the lower end of the tumbler protrudes through the stock, and serves for a trigger. The feather spring is a thin piece of steel pinned to the back of the tumbler pin, or trigger; the upper end of which, pressing against the hinder end of the lever, causes the notches of the tumbler to fall into a corresponding notch of the dog.

The inventor claims, as his exclusive improvement, the form and arrangement of the parts of the lock, so as to render it more simple, safe, certain and effective.

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Specification of a patent for a machine for Grinding Flax Seed, and other kinds of grain, paints, medicines, and other substances. Granted to Asahel Cross, and Ezra Brown, Cazenovia, Madison County, New-York, February 4th, 1830.

On a horizontal shaft two feet six inches, or three feet in length and ten inches from one end of the same, is placed a cast iron wheel, eighteen inches in diameter, and one inch, or more, in thickness; the flat sides of which are turned straight and smooth. Two cast iron wheels, or cylinders, nine inches in diameter and four inches in thickness, the circular surfaces of which are turned straight and smooth, are placed on two shafts, two feet in length and near one end of the same. These shafts are placed in a horizontal position across, and at right angles with, the first mentioned shaft, and from three to four inches below the same (measuring from centre to centre) one on each side of the flat wheel, and in such a manner as to bring the smooth surfaces of the cylinders in contact with the smooth sides of the flat wheel; the outer ends of the cylinders extending as far as the outer extremity of the flat wheel at the point where they come in contact. The pivots on the ends of all the shafts run in boxes of metal, or other substance, attached to a frame prepared for the purpose.

The perpendicular flat wheel constitutes the principle of the improvement in the above machine, by operating between two cylinders or rollers, similar to those heretofore in use.

*Operation.* This machine is propelled by water,

hand, or other power, by attaching a pulley and strap, or other gear, to each shaft. The seed &c. is fed from above into the machine, on each side of the flat wheel, between that and the cylinders. The flat wheel and cylinders are put in motion in a direction calculated to draw the feed between them; the flat wheel and cylinders making an equal number of revolutions in the same time. For some uses, this machine may be made much smaller than above described; but the flat wheel and cylinders should be nearly in the same proportion to each other.

The principle of this machine in its operation, in its improved form, is, it breaks the seed or substance, and at the same time, by the raking motion of the flat wheel against the cylinders, in consequence of their being placed below its centre, it effectually grinds or pulverizes it.

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Specification of a patent for an improvement in forming the Nap upon Woollen Cloths. Granted to Zachariah Allen, Providence, Rhode-Island, February 2nd, 1830.

This improvement consists in extending the cloth, upon which it may be required to raise a nap, very smoothly and firmly over a solid arbour, or edge, and in causing the wires, or cards, set in a cylinder, to act only upon that portion of the cloth which is passing in actual contact around, or over, the solid arbour or edge; thus bringing the wires to act by a gauge or screw with accuracy and certainty upon all parts of the face of the cloth, and at the same time to penetrate no farther or deeper into the texture of the fabrick, than may be found proper to raise a nap without injuring the texture of the cloth.

The improvement herein claimed consists in causing the wires to act upon a portion of the surface of the cloth extended smoothly over a solid body, so that every part of the cloth, thus extended on a hard surface or solid body, may be brought under the action of the wires without a possibility of retracting therefrom, or bagging in the looser parts, and without having some portions of it more intensely acted upon than others, whereby the nap is not only unequally raised, but the cloth itself is subject to be chafed through and damaged, as is the case when it is attempted to raise a nap otherwise than when extended upon a hard, smooth surface or cushion.

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Specification of a patent for certain improvements in the process of Finishing Woollen Cloths. Granted to Zachariah Allen, Providence, Rhode-Island, February 23d, 1830.

This improvement consists in laying the folds of woollen cloths smoothly between metallick plates, and in this state immersing the cloth in steam or heated water, and in subjecting the cloth, whilst thus immersed in steam or hot water, to a heavy pressure, by means of a screw or otherwise. After remaining for a short time in this state, the cloth is allowed to become cold, or may be suddenly cooled by cold water, when it is to be withdrawn from the press. The cloth is then to be again folded in such a manner that those portions of the edges of the folds which were not subjected to pressure in the first instance, may be exposed to pressure in the second operation, which is to be completed in the same manner as the first. To prevent any marks, or impressions upon the cloth, from the edges of the plates, the cloth may be laid in folds of its full width, and made to extend together with the edges of the plates of metal by means of thin boards introduced between them, and of less superficial dimensions than the plates.

After undergoing the process, all sorts of woollen cloths are found to be rendered permanently more compact in texture, and consequently more serviceable in retaining warmth and excluding moisture, although comparatively more thin and light, whilst at the same time the cloth is rendered more smooth and glossy.

The improvement here claimed, and the advantages of this process over the usual mode of pressing woollen cloths, in a dry state, either cold, or with hot plates of metal, consist in the following circumstances, or parts—wool being a material very similar in its nature and properties to horn, (of which combs and other articles are formed,) if it be required to make any permanent alteration or impression on the texture of any fabrick composed of it, the fibres of wool must be rendered pliable by remaining immersed in hot water or steam. Whilst in this pliable and yielding state it may be easily compressed, or moulded to the desired form, and if allowed to become cold before this compression is removed, the form impressed will remain permanently. On the contrary, when pressed in a dry state the fibres of wool retain all their elasticity, and however intense the pressure may be upon them, they will soon recover their former position, and the effects will be transient.

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Specification of a patent for a composition called Leather Paper. Granted to Ephraim F. and Thomas Blank, of the City of New-York, February 16, 1830.

This new and valuable invention or discovery, consists of the art of making a *paper* from the refuse parings or shavings of leather, which is peculiarly and admirably fitted for sheathing vessels; and which is believed to be superiour to the sheathing paper, or leather, both of which are now in general use for that purpose. It may also (after suitable preparation,) be used for most of the purposes to which leather is applied, as the manufacture of patent leather, caps, pocket books, and for all kinds of book binding.

The mode of forming the patent *leather paper*, is similar to that of the manufacture of paper from rags. The shavings being ground, or beaten to a proper consistence, are put into a suitable mould, from whence they are taken to the press. The colour of this paper may be varied according to the quality of the shavings used, or by a chemical process. It may be brought to such a degree of fineness and whiteness as to be equal to the finest writing paper.

The subscribers claim the sole privilege of using their patent *leather paper* in the manufacture of *any article* to which leather or paper is applied.

The making of sheets from the ground parings or shavings of leather has been frequently attempted in the way above pointed out. Some years ago it was stated in the publick papers that a manufacture of the kind had been established in Germany, and the manufactured sheets applied to various purposes. We have seen specimens of such sheets made in the United States, and have no doubt that the experiment has been tried by many of our paper makers. The sheets so made

want that toughness which results from the organized animal fibre in the unbroken skin. By means of size and pressure, a very good appearance may be given to such sheets, but still they will bear the same relationship to leather which paper bears to cloth.—[*Ed F. Institute.*]

### *On Purifying Linseed and Rape Oils.*

BY MR. THOMAS COGAN.*

Of the seed oils, those which are in the greatest demand are from rapeseed and linseed. In France, and in most other parts of continental Europe, rapeseed oil is that which is generally used for lamps; but it will not give a clear light till it has been freed from the mucilage and other matters, which, when heated, become charred, and thus load the wick, and by obstructing the capillary action, impair the free supply of oil. Acids, properly applied, will precipitate the mucilage; but long subsidence, or tedious filtration, are necessary for this purpose; and after all, the oil is found still to retain some acid, or at least its properties have undergone some change, which diminishes its inflammability.

Linseed oil is not made use of in lamps, but there is an immense consumption of it, as the basis of oil paints, both of those that are used in house painting within doors, and of those that are employed by the artist. Linseed contains so much mucilage, that it is necessary to roast the seed, more or less, in order to enable it to give out its oil to the action of the press; and on this account the oil, which naturally has only a pale yellow colour, is generally a reddish brown, from the previous roasting of the seeds, and still contains also a considerable proportion of mucilage. By separating from the oil this scorched mucilage, it is much improved as a vehicle for white and pale colours, and is also better able to resist the action of air and weather.

M. Thenard was, it appears, the first who published a method of freeing seed oils from their mucilage, by the action of sulphurick acid; but the subsequent separation of the charred matter, by long standing, or by slow filtration, was a great objection to the process; and the attempt to wash out the remains of the acid, by mechanical agitation of the oil with water, either cold or warm, was far from being fully successful.

Mr. Cogan's process, though resembling M. Thenard's in the first part of it, is completed by the judicious introduction of steam; by means of which the oil appears to be almost entirely freed from acid, and the black feculent dregs subside in the course of twelve hours, leaving the supernatant oil quite clear, and greatly improved in colour, and in those qualities for which it is valued by the painter.

The quantity that he operates at once is about 100 gallons. For this, three quarts, that is, about ten pounds of sulphurick acid (oil of vitriol) is required. The acid is to be diluted with an equal bulk of water. The oil being put into a copper pan, of the shape of a boiler, two quarts of the dilute acid are to be added: the whole is then stirred up very carefully for an hour or more with a wooden scoop, till the acid has become completely incorporated with the oil, and the colour of this last has become much deeper than at first. A second similar quantity of acid is then to be added, and mixed with the oil in the same way as the first was; and after this, the remaining third part is to be added. The stirring of the oil is to continue incessantly for about six hours in the whole, at the end of which time the colour of the mixture will be almost that of tar. It is then to be allowed to stand quiet for a night, and in the morning is to be transferred to the boiler; this is of copper, and has a steam pipe entering it at the bottom, and then dividing into three or four branches, each of which terminates in a perforated plate. The steam, thus thrown in, passes in a very divided state into the oil, penetrates into every part of it, and heats it to the temperature of boiling water. The steaming process is to be continued for about six or seven hours, when the oil, &c. is to be transferred to a cooler, of the form of an inverted cone, terminating in a short pipe, commanded by a stop cock inserted in its side, a few inches from the bottom. After remaining a night in the cooler, the oil is fit to be withdrawn; for this purpose the cock at the bottom is opened, and the black watery acid liquor flows out. As soon as the oil begins to come, the cock is closed, and that in the side of the cooler is opened. From this the oil runs quite clear and limpid, the whole of that which is still turbid remaining below the upper cock. The purified oil being drawn out, that which is turbid is let out into a reservoir, where it either remains to clarify by subsidence, or is mixed with the next portion of raw oil.

* From vol. XLVI, of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, just published. The Society voted its silver Isis medal, and ten guineas, to Mr. Cogan, for his discovery.

*From the Franklin Institute.*

An account of an extraordinary adhesion of the safety valve of the boiler on board the steam boat Legislator, on the Hudson. By the Engineer.

SIR,—The late awful explosion of the steam boat Helen M'Gregor, has brought to my recollection an accident that occurred last summer under my own eye. Believing it may serve the cause of humanity, I think it my duty to make publick the fact; it is this.

Last summer I was engineer on board the steam boat Legislator, belonging to Hudson; standing on the forward deck, I noticed that the engine was working faster than common, and not seeing any steam flow as usual from the safety valve, I started for the fire room, where I met the fireman then on duty; he told me that he had on 21 inches of steam, and that the rod in the steam guage was up against the boiler deck. As the safety valve was loaded to carry only 16 inches, I became alarmed, and went to the fire-room and took hold of a cord that ran over a pulley and was attached to the lever of the safety valve, and attempted to raise the valve, but could not; I was still more alarmed, and went on the top of the boiler, where the safety valve was, and found all right there, that is, there was no extra weight on the valve; I then slided the weight in to the length of the lever up to the fulcrum, where the weight was merely nominal; still the valve did not rise; I became confounded; I took hold of the lever and lifted on it pretty stoutly, and continued lifting for some seconds, when all of a sudden, with an explosion like that of the report of a small field piece, the valve opened, and the steam rushed out violently; it continued to do so for some length of time before the steam got down to the usual pressure, the engine being at work all the time. There was no water on the valve, nor any visible obstruction to its rising of its own accord after the steam got beyond the pressure of 16 inches, which it had invariably done before. Now, sir, must not this obstruction to the valve rising have been caused by an adhesion that took place between the valve and the valve seat, both of the same metal—I think it certainly must have been caused by this adhesion of the metal only. I have had an experience of 12 years as an engineer, and never knew the like occurrence before. For many reasons I have not placed full reliance in the mercurial steam gauge, but have always had entire confidence in the correctness and safety of the safety valve; but in this case I was deceived, and perhaps in a few moments more an explosion might have taken place, for I have no doubt that if the small rod in the steam gauge had a free passage through the boiler deck, it would have denoted 30 instead of 16 inches.

It is usual on board steam boats to have the steam gauge so graduated as to show as many inches of steam as the engine will take, and to have the safety valve loaded so as to agree with the steam gauge, believing that when the steam gauge indicated 16 inches of steam, all the surplus steam would escape through the safety valve; engineers, or many of them, are in the habit of not blowing off any steam when the boat stops to make a landing, but depend wholly on the safety valve rising of itself after the steam has risen a little above its required height. This has been considered a safe way of proceeding, but the case stated above shows, most conclusively, that it is wrong to depend too much on the safety valve. I would recommend, by all means, that when a boat stops to land passengers, that the safety valve be raised, let the gauge indicate what pressure it may; this, sir, is the only safe way. Might not the engineer of the Helen M'Gregor have placed an implicit confidence in his safety valve rising when the steam had got to its required height, and is it not possible that an adhesion had taken place between the valve and the seat? and perhaps at the same time he was waiting for the valve to rise, he had double the required quantity of steam, which caused the awful explosion; such may have been the fact. Before the occurrence of my safety valve not rising when it ought, I had believed the cause of boilers exploding was, almost invariably, the want of a sufficient quantity of water. I now think some explosions may be attributed to the being deceived by the safety valve not rising as was expected by the engineer. If you think the above stated facts are worth a place in your valuable Journal, you are at liberty to insert them. You will please to word and arrange this account to suit yourself. I know nothing about making out a statement for a publick print, but you may rely on the correctness of the fact above narrated; it can be testified to by the pilot, the clerk, and the fireman of the boat.

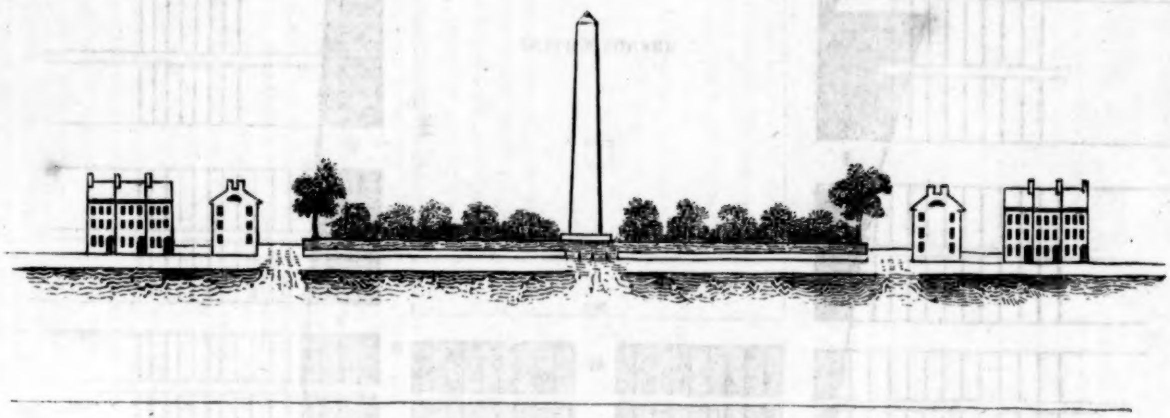
Your obedient servant,

JOHN B. CALHOUN, *Engineer.*

*New-York, April* 12, 1830.

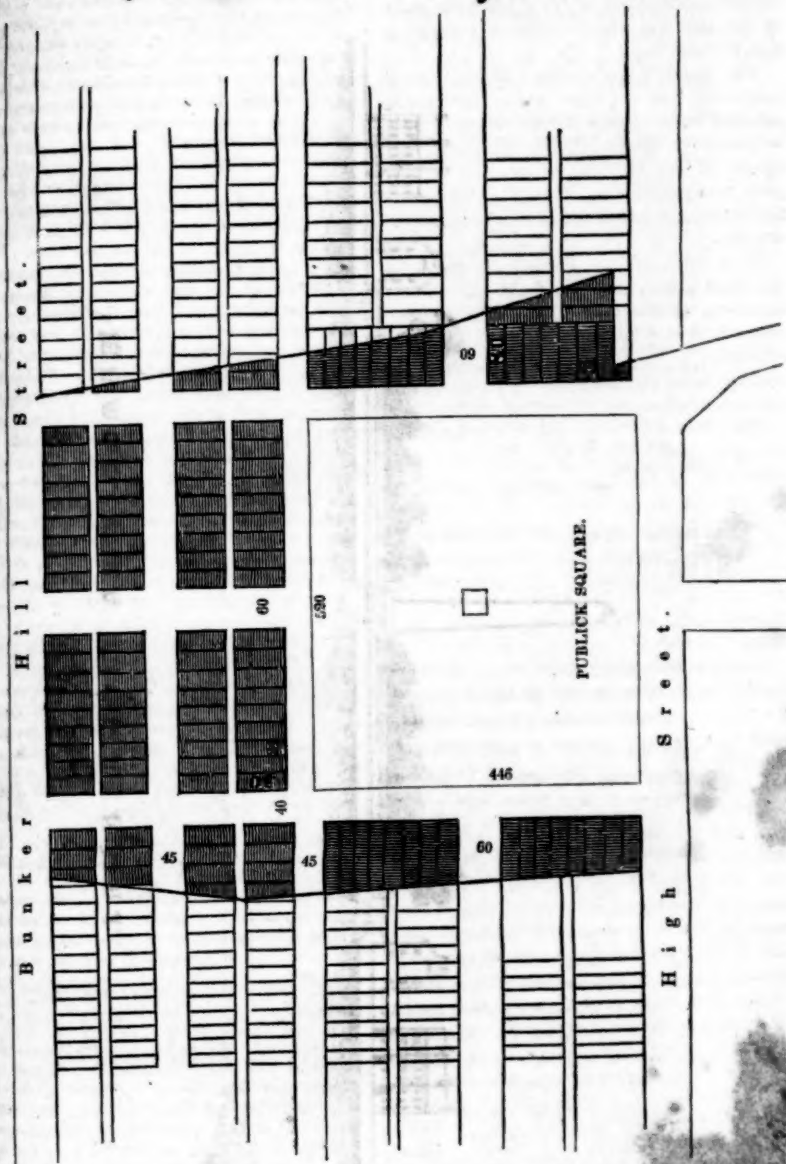
*Remarks by the Editor of the Institute.*—We insert the preceding communication in the form in which it was received, and shall always be much gratified by the correspondence of observing practical men upon subjects with which they are conversant. The simple, unpretending style in which the foregoing facts are narrated, could not be improved by any effort of ours.

We differ from Mr. Calhoun in his estimate of the value of the mercurial steam gauge, and think that the case stated must convince him of its utility. In order to judge of the cause of the adhesion, the exact form of the valve, and other circumstances relating to it, ought to be known. So far as the account goes, it appears that there was, in the present case, an actual adhesion of the valve to its seat, which, although not unfrequent to a certain extent, existed with a degree of force which was extraordinary. Our scientifick readers are acquainted with that kind of adhesion which was first brought into general notice by M. Clement, of France, and which has since given rise to much discussion; there is nothing, however, to lead to the conclusion that the present case was in any way related to it, as an emission of steam would then have accompanied the adhesion. Our wish is to excite discussion rather than to offer opinions; we shall, therefore, leave the question, at present, to our correspondents.



VIEW FROM THE SOUTH.

W S Chapel



Bunker Hill Street.
High Street.
PUBLICK SQUARE.
520
446
60
40
45
45
60
60

The Bunker Hill Monument has been the theme of so much inquiry, doubt and even reprehension, that we are glad of an opportunity of laying before our readers a concise explanation of what has been done by the directors since the act of incorporation was granted.

The publick are always correct in their judgment, but are often sadly mistaken in point of fact. It will therefore appear and be generally conceded, we trust, that the agents of the publick in performing the great and responsible duty of constructing the monument have been faithful and praiseworthy.

In a work of that kind, permanence is the great virtue. Every thing ought to be sacrificed to that; and to ensure permanence it is inevitable that the sums usually expended in repairs should be absorbed in making these preparations which alone can prevent the necessity of constantly rebuilding.

The slowness with which subscriptions are now obtained, even from the most generous part of the community, to complete the work, is an evidence of the reluctance with which any application to contribute to its support would be met, had the directors expended the money with the haste, and in the manner, which the complaints of some persons seem to indicate they should have done.

It is not surprizing however, that there should have been so much anxiety upon the subject, nor that the anxiety should have been so fearlessly expressed. We are so unaccustomed to works of ornament that any expenditure which is not immediately followed by practical utility is suspected. Now that the whole matter is before the publick, we have no doubt that satisfaction will follow, and we hope that the idea of reducing the original plan of the monument to the height of one hundred and sixty feet will be found to be an unnecessary resort, let it be completed two hundred and twenty feet high, even if we have to wait for a more prosperous era, and a more enterprizing generation.

A friend has furnished us with the foregoing plan of the monument, publick square, and surrounding ground, as laid out in building lots, 24 by 80 feet, and the following is extracted from a pamphlet lately published by the members of the association.

The engraved sketch, is intended to exhibit the appearance of the work when finished, viewed from the south. Respecting its magnitude, and the means originally possessed by the Association, the publick do not appear to be well informed. Of the variety of designs which were presented, the Obelisk was considered, the most appropriate, by the committee of artists and scientifick men to whom the subject had been referred; and one of the smallest size, as best adapted to the means at their disposal. The dimensions of the one finally adopted, being 30 feet at the base, 15 at the top, and 220 feet high, with a circular stairway winding round a hollow cone.

The estimated cost of the structure, made at the time by an able engineer, with the aid of an experienced stone mason, was $100,000. It was made for Quincy stone, and for courses of 18 inches rise. (The various items compared with similar work, executed before, and since that time, will show the fairness of the estimate.)

According to the Treasurer's last report, the original subscription, together with the grant of the state, amounted to $64,010 55 cents. This sum being the total amount furnished, and at the disposal of the Association, both for the purchase of the land, and for the prosecution of a work estimated at $100,000 cost!

It has been supposed, very generally, that the sum originally obtained, was greater than it proves to have been; and that it had been mis-spent. It may be well to explain the manner in which it has been appropriated.

Of the original sum of $64,010 55 cents, $23,232 43 cents was paid for a part of the battle-ground, amounting to about 15 acres; $7,201 81 cents for laying the corner stone, for books, engravings, &c. &c.; amounting, together, to the sum of $30,434 24 cents; which, being deducted from the original sum, leaves $33,576 31 cents, as the sum total left to be applied to the building of the Monument. This sum was farther diminished by the cost of the hoisting and quarrying apparatus, which was indispensable in the prosecution of a work of such magnitude. The remaining sum, with a loan of $23,400, supported the work from its commencement until it was finally suspended. The apparatus is now on hand, and worth, to the Association, half of its first cost.

There has also been an unfavourable opinion respecting the progress of the work. People have generally formed their judgments of its progress by the height attained. The only correct way, is, by the tonnage. The total number of tons required for the Obelisk, 220 feet high, is 6,686. More than two thirds of this quantity is already quarried, and more than half is now at the site of the Monument. Taking every thing into consideration, the work is considered two thirds completed. The whole sum expended, after deducting half of the cost of the apparatus, is $51,833 17 cents, as is shown by the last report of the Building Committee. This sum, divided by two thirds of the

whole number of tons, will give $11 63 cents, nearly, as the cost per ton, laid in the work, including the quarrying, dressing, transportation, hoisting and laying, mortar, iron cramps, clearing ledges, superintendence, and every other expense. Then $1,163, the cost per ton, being divided by 13, the number of cubick feet in a ton, will give 89½ cents, nearly, for the cost per foot cubick measure, laid in the work.

The cost of the quarrying has amounted to 7½ cents per foot, with an allowance of one quarter for waste; or to 10 cents, measured after being laid in the work. The cost of transportation from the quarry to Devens' wharf, has been 75 cents per ton. The cost of the wharfing, and hauling from Devens' wharf to the site of the Monument, 48 cents per ton; equal to 9½ cents per foot, for the transportation the whole distance.

The feet of superficial dressing, exceed the cubick feet about one third, as is shown by the table. In ascertaining the quantity, the net surface, only, was measured; nothing extra being allowed for circular work; and two feet of the coarse hammering was allowed to be equal to one of fine.

The average cost of the dressing has been about 36 cents per foot, superficial; and the details of the expense of a foot of stone when laid in the work, will be as follows, viz:

| | |
|---|---|
| Cost of quarrying per foot, laid in the work, | 10 cts. |
| " 1⅓ feet of dressing, at 36 cts. per ft. | 48 |
| " transportation the whole dist. per ft. | 9½ |
| " hoisting and laying, mortar, iron cramps, clearing ledges, with every other expense, | 22 |
| Total cost, per ft. laid in the work, as before stated, | 89½ |

To carry the work 160 feet high, will require an extra quantity of stone, equal to 1,384⅔ tons, which, at $11 63 cents per ton, will amount to $16,103 67 cents; to which, if we add $23,400, the sum due on the loan, it will amount to $39,503 67 cents; the sum total required to pay the loan, and to finish the Obelisk 160 feet high, and the whole cost, finished to this height, will amount to $67,936 84 cents, at the above rate; or to $77,758, 220 feet high.

The engraving exhibits, also, the plan of the ground which belongs to the Association, laid out in a manner nearly similar to what was originally proposed. The square, according to the original plan, was to contain five acres. It was thought expedient, by the Directors at the time, to purchase a larger space; and a quantity was finally bought, amounting to nearly 15 acres, which extends from High street to Bunker Hill street, as is shown on the plan. Should this plan be adopted, the square will contain about 6 acres; and 8 acres, including the streets which surround it. There will be 56 lots fronting on the square, about 24 by 80 feet long, equal to 1,920 feet, which, at 25 cents per foot, will amount to $26,880; and 64 back lots of the same size, which, at 10 cents per foot, will amount to $12,288. Total amount, at the assumed prices, $39,168; a sum nearly sufficient to pay the debts of the Association, and to build the Monument 160 feet high. The sales of the land, in the vicinity the past season, will be good evidence as to the intrinsick worth of the ground.

The project for retaining the whole of the ground, now owned by the Association, has recently been suggested. Should this course be followed, the sum of $39,503 67 cents must be raised, either by subscription, or in some other mode. It remains for the members to decide whether they will follow the recent suggestion, or the original plan. Should they think it advisable to follow the original plan, it might be proper, at the next election of officers, to appoint an efficient Committee, and to instruct them to dispose, forthwith, of all the ground not wanted for a publick square.

## WATER.

In a former number we gave a description of an apparatus for boring the earth for water; one of the last experiments made with the machinery, attended with the most complete success, was made upon land owned by Mr. Ephraim Marsh, in the south part of our city. After boring to the depth of about 100 feet the augur struck a vein of pure spring water, which instantly ascended the tube to about 1 foot above the surface of the earth, and continues to yield a copious supply of excellent water.

Some of our readers may have noticed in the shops, in Washington street a very pretty kind of time-piece, so contrived as to represent a stream of water gushing from the pedestal, (a very pretty idea—effected by a convoluted glass cylinder, clear as crystal,) this artificial stream will serve to give them an idea of the real jet of water as it spouts out from the iron tube at the above mentioned place.

It is the opinion of many persons in the city, from the number of springs which have been found, that numerous springs, or currents of fresh water, pass under us at considerable depths, and find their way out to the ocean. Indeed, it was very gravely told us by a gentleman,—and we doubted not *his* sincerity—that some few years since a pump in Essex street, which had always been celebrated for its generous discount of pure fresh water, suddenly disappeared downwards, handle and all, leaving the neighbourhood in utter consternation, till sometime afterwards it was picked up in

the bay by a party of fishermen! Proving to a certainty, as he thinks, the existence of a subterraneous river of considerable magnitude.

We quote the following from the Evening Gazette, to corroborate our assertion, in part:

"Without any pretence of revealing mysteries I wish to give my views on this subject. From nearly fifty years of observation and experience in building and digging in every section of the city, I have come to the conclusion, that pure fresh water runs through, or under, nearly the whole peninsula of Boston, sufficient to supply the inhabitants for all purposes, without any artificial aqueduct from Spot Pond, or any other pond. The method which is generally adopted to obtain it has been by digging or boring, until we strike a stratum of sand, that affords good water, which will rise to the height of the fountain from which it is drawn. Sometimes on the side of Beacon Hill, it runs out freely above the surface; in this case there is no doubt of its being deposited in a reservoir above, supplied by the rain which falls on the surface of the earth; within a short distance of that you may dig and bore 150 feet before you can obtain water. In the first case the supply is from what is called the upper spring, or the surface water; in the second from the lower spring, or water that is passing through or under our city, which may be deposited in Spot Pond and conveyed by a natural aqueduct under us to supply the fish. The latter is effected more or less by the rise of the tide, although it is often found from 60 to 100 feet below the bed of Charles River, and will rise some feet above low water mark. Well then, we would ask if the fountains are good, why are not the streams good? They are—but are often spoiled by the place in which they are deposited; for instance, we dig and bore our wells until we obtain water from the pure fountain, and find it very good and in abundance, but it is retained in this well, which is generally from 20 to 100 feet deep and stoned or curbed with wood, and surrounded by good and bad earth, which is filled with gas, and which connects with this pure water and spoils it, and this water we are constantly using. Another evil is, in a very deep well, with a wooden pump, (say from 60 to 100 feet) filled with water, standing in wood, iron, copper and leather, but few families use as much water in 24 hours as such a pump contains, so that we are sure not to have any fresh water from the fountain.—I believe it is impossible to retain good water in our low, marshy or clayey soils in wells curbed with wood, stone, or brick, that this gas will not force through and spoil. Again, we suffer by depositing this pure water in large wells, whereby we are always using the old water. I think if we could take our water from the fountain in iron tubes, or any other metal that would resist the gas and not spoil the water, we should not have to complain for the want of good water and enough of it. The boring and putting down tubes has been practised here for forty years.—Mr. West, of New-York, has been recently engaged in boring for water, in this city, and sinking cast iron tubes of about 4 inches in diameter. We hope, however, his boring in the city will not deprive our Charlestown neighbours of another well of water, as we understand was the case some time since, when a well which was dug in Prince street, actually drained a very fine spring in Charlestown, proving incontestibly the existence of a communication under the bed of Charles River.—I could say much more upon this subject, but my principal object is to elicit some observations from scientifick men in this vicinity, who will be able to do it justice.—*The preceding remarks are from a mechanick, who is willing to give up all his old prejudices and experiences for any new improvement which is more useful.*"

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*Abstract of a lecture on the Manufacture of Pins, delivered by Dr. Birkbeck, at the London Mechanicks Institute.*

In a recent lecture of Dr. Birkbeck's, at the Mechanicks' Institute, while pointing out the advantages to be derived from the use of machinery as a substitute for human labour, he adverted to the various processes employed in the fabrication of a pin. He observed:—

"It has been stated that no less than eighteen individuals are employed in the manufacture of this little implement, some have extended this number to twenty-five, but they must have included processes which occur previous to the drawing of the brass wire. The manufacture of wire, by drawing it through a steel plate fixed perpendicularly on a table, is supposed to have originated at Nuremburg or Augsburg, in the fourteenth century, but the present mode of drawing it through a steel plate, by the

addition of revolving cylinders, urged by horses, water, or steam, is of comparatively recent invention. This draw plate is pierced with a number of conical holes of different sizes, the size of the smaller orifice determining the diameter of the wire, which is seized by a strong pair of nippers, and forcibly drawn through these holes when the plate is placed on the draw frame. As the pin maker requires a very small shaft for his pins, the wire is made to pass through the smallest holes in the draw plate; it then requires to be made straight, and the business of the pin maker commences by cutting it into lengths sufficient to make six pins." One of these steel draw plates was exhibited to the audience, after which it was placed on a draw frame, and a piece of thick wire was drawn through several of its orifices in succession, and was elongated in proportion to the diameters of the holes through which it had passed. By this process the wire became so much heated that the lecturer could scarcely hold it, and he observed that "the evolution of heat arose (as in the operation of hammering) from the approximation of the particles of the metal by the violent pressure it had undergone, which had forced out its latent calorick and rendered it sensible. Lord Bacon, according to his view of the nature of heat, concluded, that the rapid change of temperature, which accompanies hammering, was occasioned by a rapid vibration of particles; but in drawing wire, there is no vibration at all commensurate with the quantity of calorick evolved. Gold and silver wire, after undergoing this process (which does not diminish malleability or ductility) is frequently flattened, by passing it between two steel cylinders revolving very near to each other; this was a very important improvement, as the fine and costly wire used in forming gold lace is made to cover three times as much space as if in a cylindrical form.

"The boy who points the pins, takes about a dozen of the lengths of wire in his hand at once, and a spectator is astonished by the dexterity with which he contrives to keep them all revolving on their longitudinal axes, while he applies their extremities, first to a coarse grinding stone, and then to a finer one, revolving near the other on the same axis, to give them the necessary polish. The revolution of the wires is necessary to prevent the ends from being ground flat, and so rapidly is the operation performed, that a boy will point 16,00 pins in an hour. As soon as the two ends of the wire are pointed, a pin is cut from each extremity, and the pointing is repeated till six pins are cut from each wire.

"The process of making the heads of pins, or, as it is termed, head-spinning, consists in causing a finer wire to revolve with great rapidity round a straight piece of wire of proper diameter, which is afterwards drawn out, leaving the spiral coil in the form of a hollow tube, which is then cut into pieces, every two rounds of the wire making one pin's head. The heads are then put into an iron pan, and made red hot to soften them, after which they are ready for use; and the next important point is to fix them properly on the shafts. In the year 1543, it was enacted by statute 34 and 35 of Henry VIII., cap. 6, 'That no person shall put to sale any pins but only such as shall be double headed, and have the heads *soldered* fast to the shank of the pins, well smoothed, the shanks well shapen, the points well and round filed, canted and sharpened.' But in our times, no man could get a living at pin making, if he had to *solder* the heads on, or fix them by riveting. All that is now required is for a boy to thrust the shaft of a pin amongst the heads, and catching one of them on its extremity, he fixes it firmly by striking it with a hammer on an anvil with a small hole in it. This is done with surprizing rapidity, and the principle cause of the firm adhesion which takes place between the head and the shaft, appears to be the attraction of cohesion allowed to operate by the closeness of contact.

"When the pins are thus completely formed, they are whitened by placing them in a vessel containing a solution of grain tin in tartarick acid, or the lees of wine. In this process we have an advantage, as to brilliancy of surface, over the continental pin makers, who use lead and mercury instead of tin; and it is said, likewise, that on this account, a puncture from a British pin is of much less consequence than when made with a foreign one. The pins, when thus whitened, have still a dull appearance, which is removed by agitating them in a tub containing bran; and the pins being thus polished by friction, the bran is detached by winnowing, exactly as chaff is separated from grain. The pins are then ready for the final process of papering, an operation not easily understood, as to the mode of folding the paper and the rapid introduction of the pins, without seeing it actually performed."

## DECOMPOSITION OF WATER.

"Sir,—A friend of mine having purchased a small galvanick battery, consisting of twelve pairs of 4-inch plates, arranged on the principle recommended by the late Dr. Wollaston, I was desirous of ascertaining its power; and for this purpose I endeavoured to decompose water by its agency, convinced in my own mind that if a battery of that small number of plates would effect the decomposition of that liquid, most authors who have written on the subject must have been mistaken on the intensity of a battery required for that purpose. Two glass tubes, three-eighths of an inch in diameter and three inches long, were fitted with corks, and platina wires passed through the corks to the bottom of the tubes; the tubes were filled with water, and placed in a glass containing the same fluid. On making the circuit of the voltaick electricity by connecting the poles of the battery with the platinum wires, exceeding minute globules of gas were seen to rise in the tubes; and it would have taken the action of the battery for many hours to procure sufficient gas for the purpose of determining its properties. We were anxiously watching the experiment, when, by accident, I poured a small quantity of dilute nitrick acid into the glass containing the tubes,—immediately great quantities of gas were seen to rise in both the tubes. Could this increased action of the battery be caused by the nitrick acid? was our immediate inquiry. A small quantity of pure nitrick acid was poured into the glass, and again the power of the battery was considerably augmented, so much so that the tube in connexion with the negative pole was filled with gas in the space of a few minutes. We then applied the usual tests to discover whether we had obtained the component parts of water, or any other gases; but on applying a lighted taper to the tube containing the gas evolved from the negative pole it instantly inflamed, and a small piece of lighted wood inserted in the other tube burnt with increased rapidity. This was a convincing proof that oxygen and hydrogen were procured by the decomposition of the water. But was the acid the means of increasing the power of the battery, or did it decompose the acid? I am convinced the acid was not decomposed, for during the whole time of the experiment the volume of the gas at the negative pole was double that at the positive. If the acid had been decomposed, we should have obtained two and a half volumes of oxygen and one volume of nitrogen; instead of which, two volumes of hydrogen and one volume of oxygen were the result. I must then conclude, that in some way or other nitrick acid does assist the decomposition of water by means of the galvanick battery."—(L. M. Mag.)

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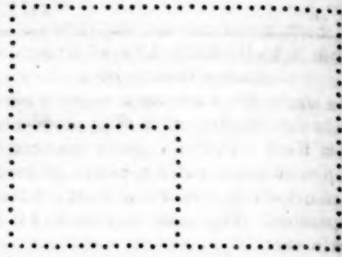
COMMUNICATIONS.] [FOR THE MAGAZINE.

## MATHEMATICAL QUESTIONS.



1. A gentleman purchases a piece of land in form of a parellelogram, and encloses one-fourth part (as per figure) to build a house and other conveniences upon, now he desires the remainder of this land may be divided into four parts, equal and similar to each other, to be appropriated to such uses as he shall hereafter think proper. The plan is required?

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2. A joiner having a plank that is 10 feet by 2 feet, wishes to make of it a square table, equal in area to the said plank, but not to exceed six segments, and would be greatly obliged to any one who will draw the plan how the said plank must be cut and applied together,—Also, what will be the size of the square when finished?

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3. The product of 2 numbers is 21952 and they are in the ratio of 7 to 4. *Quere*, what are the numbers by common arithmetick?

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Mr. Editor,—I wish to inquire, through the Magazine, why late writers on chymistry do not conform to the nomenclature in the terminations of Morphia, Strychnia, Detphia, &c. In all works on chymistry, which I have seen, these alkalies are terminated with *ne*, instead of *ia*; thus we have *Morphine*, *Strychnine*, &c. There is probably some good reason why this termination is used, as writers of great celebrity have adopted it, and perhaps some of your correspondents will be good enough to point it out to

L. S.